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MARCH 3, 1888.

THE AMERICAN ARCHITECT AND BUILDING NEWS

VOL. XXIII

REGULAR EDITION

NO. 636.

ARCHITECTURE

ENGINEERING

DECORATION

CONSTRUCTION

TICKNOR & COMPANY

BOSTON MASS.

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House, Chestnut Hill, Phila., Pa.
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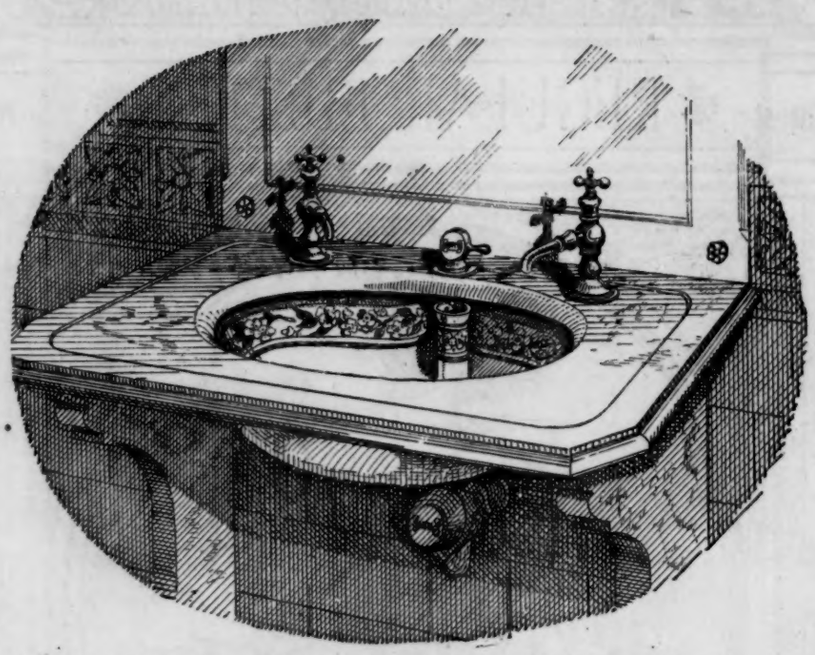
THE SANITAS LAVATORIES.

(BASIN, BATH-TUB, PANTRY-SINK.)



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Entered at the Post-Office at Boston as second-class matter.

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A PRACTICAL MAN writes to the *Oesterreichisch-ungarischen Eisenzeitung* some of his observations about the action of cement upon lead, which are new to us. Every one knows that bits of plaster, falling from a ceiling into a lead-lined cistern or tank, will often perforate the lead in a few weeks, and experiments carried on in Germany have demonstrated that under certain circumstances there is a strong chemical action between lime or cement and lead, but just what the circumstances are under which the action takes place no one seems to know. The Practical Man does not know, any more than other people, but his experience seems to show conclusively that certain qualities of lead are affected, while others are not. His first observation was made in 1880, when he was summoned to look for the cause of a leak in the ceiling of a room in the house of Count Karolyi, in Budapest. Over the room was a bath, made in a manner which is, we hope, peculiar to the Danube provinces, by building a brick enclosure in cement, plastering it inside with cement-mortar, and then casing over the outside with marble, and lining the inside with heavy sheet-lead, over which was put a thick coat of cement, in which were set tiles, to form the visible interior lining of the tub. On pulling away the marble, and breaking out the tiles, the lead-lining was found to be very badly corroded on both sides. On one side it was eaten through, so that the water escaped, and soaked into the masonry beneath, and on the other, although not perforated, the metal had become converted into a brittle, powdery substance. A year later the same expert was called to the house of Count Zichy, where a wet spot showed itself under a bath-room. This bath was precisely similar in construction to the leaky one of the year before, but had been in place for a much longer period, so the Practical Man and his assistants tore it to pieces with confidence, sure of finding the lead corroded by the cement. To their surprise, after the tiles were removed, the lead proved to be in perfect condition. No trace whatever of corrosion could be discovered, and the leak was soon afterwards found in a waste-pipe. As there was no apparent difference in the circumstances, the immunity of the Zichy tub from corrosion was quite as inexplicable as the perforation of the Karolyi one, and the Practical Man did not try to account for it. However, these cases seemed to interest him in the matter, and he took pains to collect specimens of lead-pipe which had been buried in mortar or cement. Out of a large number of these many were found as perfect as when newly set, yet many more were corroded to a greater or less degree. With only these facts as a basis, it would hardly be possible to form any deduction in regard to the matter, but the writer of the letter very sensibly suggests that some one with more time than himself might with advantage collect samples of lead from different manufacturers, and of different brands of cement and lime, and test the mutual action of the various sorts, for the benefit of mankind.

THE present year bids fair to be one of great fire losses, the six or seven weeks already expired having been distinguished by about an equal number of very destructive conflagrations. The total losses by fire last year, according to the *Insurance Standard* were something more than one hundred and five million dollars, or two million a week. This is about two hundred dollars a minute, so that supposing the cost of insurance and fire protection to be as much more, which is, we believe, nearly the case, the people of this country send up twenty-four thousand dollars every hour of the day and night in smoke as incense to the spirit of cheap construction. Of human sacrifice this American deity last year demanded less than usual, but the present season has commenced with a liberal offering, and the chances are that his appetite will be fully supplied before the year is over with the young girls and children which satisfy it best. The statistics of 1887 seems to indicate that a slight change for the better is taking place in our older communities in methods of construction. Thus the losses in New England, with a population of three and one-half millions, were but seven per cent greater than those of Illinois, which has a population of about two and one-half millions. Moreover, among the large fires, the greatest losses appear to occur in places where the art of fighting and preventing fires has not been so long practised as in the Eastern Cities. New York, as is natural for a place containing such vast accumulations of city goods, shows a large average loss, the destruction of property in the two hundred and three conflagrations which consumed more than ten thousand dollars' worth of goods during the year having been nearly fifteen million dollars, or seventy-three thousand for each. In Massachusetts the average was only twenty-seven thousand dollars, and in Pennsylvania forty-nine thousand, while it was one hundred and two thousand in Wyoming, one hundred and sixteen thousand in Wisconsin, one hundred and nine thousand in Minnesota, and ninety-one thousand in Florida.

WE have before mentioned the Asphaleia Company, which undertakes the construction and arrangement of theatres in any part of the world, and has adopted a large number of devices for improving the construction of theatre-buildings and facilitating the work carried on in them. The first theatre built by the Company was, we believe, the Royal Opera-house at Buda-Pest, and many radical changes in the arrangement of the stage and the setting of scenery were introduced there. Since then the company has built another important theatre, the Stadt Theatre at Halle So far as means permit, the Asphaleia buildings are fireproof, but by intelligent study of the problems of stage mechanism, an unusual degree of safety is secured, even with the ordinary materials. On the stage, for instance, the old-fashioned system of "fly-bridges" and light scaffolding for manipulating scenery and lights is entirely done away with. Our readers will remember the ingenious panoramic mechanism by which a painted sky, running on vertical rollers, is made to encircle the Asphaleia stage, and is gradually changed by the movement of the rollers, if the piece demands effects of sunrise, twilight or approaching storms. This device supersedes the dangerous and ridiculous "sky borders," or strips of painted canvas which depend from the upper part of the stage in most theatres, close to the gas-lights, and in the best possible place for setting the building on fire, and leaves the stage ceiling open and unobstructed. As a certain amount of hoisting of angels and other properties has to be done from the roof, wire ropes are provided for doing this work, but they are so arranged as to be operated from a single station, where is also concentrated the management of all the other stage machinery. The master-machinist, from this post, has a complete view of the stage; under his hand are levers, valves, and so on, and to him alone, with his assistant, is committed the control of all the traps, ropes and other mechanical appliances of the stage. The Asphaleia traps are simply small direct-acting hydraulic elevators, having a piston attached directly to the under side of the trap, and moving in a cylinder to which water is admitted under pressure by means of valves in the machinist's station. It is evident that theatres built on this system must be costly, but experience shows that in this country, at least, a radical novelty in the construction of a theatre is one of the surest means of attracting business.

THE *Journal of the Royal Institute of British Architects* contains an interesting note from Signor Giacomo Boni of Venice on the ancient building known as the Fondaco dei Turchi in that city. Although as purely Byzantine in type as

St. Mark's itself, and usually attributed to the tenth century, it seems, according to Signor Boni, that it was built about the year 1230, by Giacomo Palmieri, Consul of Pesaro, who was driven from his own city by a hostile faction, and settled in Venice. Although he retained his family name of Palmieri, which was inscribed on his tomb when he died, his new palace was known in the Venetian dialect as the Ca' Pesaro, from the town in which he had once been the principal citizen, and his descendants were known by the name of Pesaro until the extinction of the family in 1830. Palmieri's son, Angelo Pesaro, seems to have been very proud of his father's architectural achievement, and in his will, which is dated 1309, and is still extant, he bequeathes it to his son Nicolo, with an injunction to him, as well as to his other descendants, never to allow it to pass out of the hands of the family. Notwithstanding this, it was sold in 1381 to the Venetian Government for ten thousand ducats, and presented by the city to one of the Este family as "Marquis of Ferrara," apparently with the idea of gaining some point in advancing the Venetian claim to the sovereignty of Ferrara. The palace remained in the hands of the descendants of this "Marquis of Ferrara" until the seventeenth century, and it is not impossible that Lucrezia Borgia, after her marriage with the head of the family of Este in 1501, may have seen it in the course of her visits to her new husband's relatives, so that a little color is given to the name of the "Palace of Lucrezia Borgia," by which the building is known to the photographers. The Venetian branch of the house of Ferrara conveyed their palace, now somewhat dilapidated, to the Doge Antonio Priuli, who let it to some Turkish merchants as a storehouse. The granddaughter of Priuli brought it back, as part of her dowry, to her husband, Leonardo Pesaro, and for two centuries it continued to be occupied by Turkish merchants. In 1830 the Pesaro family became extinct, and the palace passed into the hands of Count Manin, who sold it to Antonio Petich, by whom it was let for a tobacco factory. About 1860 it was cleared of manufacturing appliances and rubbish, quietly restored, and fitted up for the reception of the Correr collection of local and other curiosities. Singularly enough, the walls of the Fondaco dei Turchi are built of small, unbaked bricks, known to the Venetians as *altinelle*, and supposed to have been brought from the ruins of Altinum, the city on the main land from which the first settlers, driven from their homes by the incursions of the savage Huns, are said to have taken refuge on the then uninhabited islands of the Venetian lagoon. The unbaked bricks of Altinum must have been of extraordinary quality to have been in condition for use in a new building nearly six hundred years after the house for which they were made had been destroyed, but it is certain that the "*altinelle*" now existing in the walls of the Fondaco dei Turchi show traces of colored plaster on them, which must have come from a much older building, and the tiles themselves seem, from their want of adherence to the mortar in which they are laid, to have had, when used, the greasy quality, familiar characteristic of very old bricks.

THE ancient writers have always held up to us the city and province of Babylon as the richest and most luxurious community that ever existed in the world. Even the Romans, whose wealth and splendor far exceeded anything that has been seen since, spoke of Babylon with a kind of awe; and there is no reason to doubt the substantial accuracy of the ancient descriptions of its walls, which were three hundred feet high, and enclosed an area about equal to that of London, of its bronze gates, its hanging gardens, or its temples, with their colossal statues of solid gold. Recent discoveries have made us certain of the curious fact that the Babylonians were not only the richest, but the most business-like of people, more so even than the Romans, who, however, followed them closely. Far from being the brutish and irresponsible slaves of an Oriental tyrant, the inhabitants of Mesopotamia have left abundant proofs of a thrift, a clearness and prudence in making contracts, a care in recording them, and an exactness in performing them, which is well worthy of our study. Every one remembers the extraordinary stores of records, made in cuneiform characters on cones of clay, and afterwards baked to render them permanent, which have been found from time to time, forty thousand having been discovered at once in a subterranean chamber; and the deciphering of the inscriptions on these, which has been going on for years, has given us a striking idea of the care with which such records were made and preserved. A few, recently interpreted, have proved to give what amounts to a map of a portion of the city of Babylon, by means of the accuracy of their descriptions of the boundaries of the lot conveyed, and the references to the rights-of-way of the adjoining owners. These particular records referred to the property of the firm of Egibi Brothers, who seem to have been merchants with a taste for investments in real-estate, and were dated in the twenty-sixth year of Nebuchadnezzar, or B. C. 579. Together with the deeds of this lot, which included a judicial decree in regard to some rights-of-way apparently disputed, the Egibi records contained numerous mortgages, rent-rolls and receipts, one of which contains a reference to a custom which may furnish a useful hint to modern landlords; the receipt acknowledging the payment of the rent to a certain date, and also the deposit of "ten shekels of silver as security for the new year." The *Builder*, which gives these interesting details, says that the cones or tablets are stamped with the seals of the contracting parties, and attested by witnesses. This must have been a good protection against forgery; and property seems to have been guarded as well by the banks of the Euphrates as it is now on the shore of the Thames.

THE lengthy quotation we make to-day from the *Congressional Record* is sufficiently interesting to be read attentively in spite of its length, and deserves all the more consideration for its short precession of the debate that will probably take place in the same body in consequence of the Public Buildings "grab" which has recently been engineered through the House. The discussion, if the somewhat informal talk really deserves that name, seems to promise that the bills for new and possibly not needed public buildings will not be railroaded through the upper House without some show of discussion, and perhaps salutary opposition. It shows that there are some influential members of the Senate who know something of the iniquities of the present routine method of grinding out Government buildings to satisfy the greed of political heelers, or gratify the aspirations of a present Member of Congress desirous of reëlection. But there is no positive proof that any one really comprehends the impossibility of effecting in the office of the Supervising Architect the mere administrative handling of the quarter of a billion of dollars of which the expenditure is to be one oft he results of the raid; while it does not seem to occur to any Senator that he ought to feel a premonitory shuddering at the possibility that in the course of a twelvemonth or so designs for one hundred and thirty or more new public buildings may be prepared under a system, which, according to the statement of a Senator during the debate, makes it impossible that these designs shall be such as would be prepared in the offices of architects of the highest rank, whose services so wealthy a Government as ours surely ought to be able to command.

IT is only fair to acknowledge that, having a very great interest in building and all that relates to it, it would give us more satisfaction to see the surplus expended in these enormous building operations which would distribute so large a sum of money through trades in whose welfare we have a concern, than to see it frittered away on any of the vast service-pension schemes or on so chimerical an enterprise as the Blair Education Bill seeks to set afoot. But the conscience of the citizen who abhors a "steal" of any kind is quickened by the feeling of the artist who knows what kind of work is likely to be turned out under the present system of procuring designs for Government buildings. If Congress endorses and the President approves the bills for all the new buildings which have been introduced, it will be distressing to imagine the harrying and worrying of the unfortunate Supervising Architect, subjected to the necessity of endeavoring to pacify the appointed representatives of one hundred and thirty communities and produce satisfactory proofs of his assurances that the public building to be erected for each is all that it should be and is making all desirable progress. To be Supervising Architect to the Treasury Department of the United States on a petty and inadequate salary may have its compensating glories, but a man must have a high regard for this very impalpable and unbankable commodity not to feel himself wronged and defrauded when he stops to consider that for less than fifteen thousand dollars he devotes four years to doing work for which, as a private practitioner, he might receive a million and a quarter of dollars.

OUR PUBLIC BUILDINGS AND OUR SENATORS.

Chateau du Rocher à Mézanger. France.

AS there probably were no architects in the Senate Chamber galleries when the interesting discussion on February 14th of some of the peculiar methods by which our Government buildings are built took place, and as the summary in the daily papers was very insufficient, we make no apology for reproducing the discussion *in extenso* from the *Congressional Record*.

Mr. Pasco. I should like to call up the bill (S. 1723) providing for the completion of the public building in the city of Pensacola, Fla., as originally designed.

By unanimous consent, the Senate, as in Committee of the Whole, proceeded to consider the bill, which had been reported from the Committee on Public Buildings and Grounds with an amendment in line 8, before the word "thousand" to strike out "fifty" and insert "thirty-two," so as to make the bill read:

That the Secretary of the Treasury be, and he is hereby, authorized and directed to have the United States court-house and post-office building in the city of Pensacola, Fla., completed as originally designed, including tower, basement and attic stories, fences, grading, and heating, and the sum of $32,000 is hereby appropriated out of any money in the Treasury not otherwise appropriated, for the purpose herein mentioned.

Mr. Edmunds. Is there a report?

The President *pro tempore*. No report accompanies the bill.

Mr. Pasco. I will state that the appropriation is recommended by the Supervising Architect and is according to the original specifications and estimates.

Mr. Edmunds. Are there any papers from the Supervising Architect on the subject?

Mr. Pasco. I have a letter from the Supervising Architect in the committee-room, stating that $32,000 will be sufficient, and upon that estimate the committee reduced the appropriation from $50,000 to $32,000. That report of the Supervising Architect was before the committee when the bill was considered.

Mr. Edmunds. I must say with great respect (not as applying to this particular case, for I know nothing about it) that I am very much afraid we are acting rather rapidly and without due consideration on the subject of public buildings over the United States — as well in the State of Vermont as elsewhere, I will add. I should like to have some definite official information about this possible change, and I should be glad if the Senator would not press the bill at this moment, and get the official papers, as the Senator has them not with him now, wherein it is represented, I have no doubt, as the Senator states, but so that it will go into the *Record* and show exactly upon what grounds it is that the Senate passes the bill.

Mr. Pasco. I should like very much to get the bill through to-day, as certain days have been fixed in the other House for the consideration of bills of this kind, and the building is in an unfinished condition. I should like very much to get the bill through to-day. As proposed to be amended it is in exact accordance with the report of the Supervising Architect.

Mr. Vest. If the Senator from Florida will permit me, I will state to the Senator from Vermont that I happen to know personally the correctness of his statement in regard to the report of the Supervising Architect. We took the matter up in our committee and examined it carefully at the last meeting, and reduced the amount from $50,000 to $32,000 in conformity with that report.

This is one of the most deserving bills of the kind that has been before the Senate. The public building at Pensacola is unfinished and its usefulness is considerably impaired by reason of that fact. A large proportion of the money necessary for the construction of the building has been expended, and this is simply to utilize it.

Mr. Edmunds. How much has the original appropriation been increased altogether?

Mr. Vest. I think this is the first increase of the original appropriation.

Mr. Pasco. This is the first increase of the regular appropriation.

Mr. Edmunds. What was the original appropriation?

Mr. Vest. It was $150,000, if I am not mistaken.

Mr. Pasco. I think that was the amount.

Mr. Edmunds. And this makes $32,000 more.

Mr. Vest. It makes $32,000 more, which is absolutely necessary to complete the building. The Department has expended the money that was appropriated. Pensacola is a very important point, and after this money has been expended nothing will remain to be done.

Mr. Edmunds. Why did not the Department keep within the appropriation?

Mr. Vest. That is one of the questions that it is beyond the ability of any Senator to answer. This thing has occurred over and over again. It has occurred in bills where we have specifically provided that the Department should not expend one dollar beyond the appropriation, and still it was spent.

Mr. Edmunds. When are we to stop it?

Mr. Vest. That is another question of the future. There are a good many questions connected with public buildings in this country. If the Senator will tell me when we are to abandon the present system, then I shall be able to tell him when we can stop it, but I am afraid that it is impossible to go into the question of the public buildings of the country now. The tariff and the Blair bill sink into insignificance when we come to that. [Laughter.]

Mr. Hale. I am afraid the Senator from Missouri is right in estimating the importance of these measures, and I only rise for the purpose of calling the attention of the Senator from Vermont to what the Senate will have to consider very soon, not only upon this bill, but upon dozens, and it may be scores, of others touching the removal of the limit that has been fixed in times past, by deliberation and due consideration, first by committees and then by Congress, upon buildings all over the country.

It has been the fashion to introduce bills and refer them to the proper committee here and in the other body, and fix a limit for the cost of the building, which ought to be the chart followed by the Department in erecting the structure. So far from that being the case, the Committee on Appropriations has before it, referred to it, estimates from the Department covering long lists of public buildings all over the country, estimating for sums beyond the limit already fixed by law.

I do not say that in a given case such a condition may not be inevitable from peculiar circumstances and conditions surrounding the construction of one of these public buildings, but that Congress should proceed deliberately and declare what a building shall cost in one place and another in twenty different cases, and that then the work should proceed deliberately without regard being paid to the limitations fixed by Congress, and we be called upon in an urgent-deficiency bill to make up the sums which it is estimated will be needed to finish the building, is something which ought to be investigated; it is something which ought to be looked into. Otherwise we may as well fix no limits hereafter to any building. Otherwise we may as well understand that we will declare that a building shall be put up in Texas, or in Maine, or in Vermont, or in Minnesota, or California, and that we leave it to the sweet will of the Department and the persons who are urging them to increase the cost and size of the building, and that we will exercise no jurisdiction whatever over the matter.

Mr. Edmunds. And that sweet will is the will of a man who owns property in the place and has charge of the building.

Mr. Hale. Undoubtedly. I hope the Senator from Vermont, in looking into this subject, will not let his efforts stop at this one building, about which I know nothing and against which I have nothing to say. Against the increase of the limit I have no arguments to urge, as I know nothing whatever about it, but I do know the general condition, that we are to be called upon in an urgent-deficiency bill, where Congress has fixed limits, in dozens, perhaps scores of cases, to appropriate more money, perhaps aggregating hundreds of thousands or millions of dollars in this direction. The Senate ought to look to it very carefully before we take any step in this direction.

Mr. Vest. If the Senator will permit me, I do not see the chairman of the Committee on Public Buildings and Grounds present, but I simply want to state that we are now wrestling with this question.

Mr. Hale. With the question of expending beyond the limit of appropriation?

Mr. Vest. With the question of limiting the expenditure. We have before us three bills, and we passed all our time at the last meeting of the committee in considering the propriety of enacting some general measure which would apply to the whole country. The Senator from Kansas (Mr. Plumb) is very much interested in this subject. All I want to say, in justice to the committee, is that our next meeting is called specially with reference to this very matter, and we propose to formulate and bring into the Senate a general bill. It is a very difficult subject. The Postmaster-General dealt in his report very largely with it, and formulated a bill which was introduced at the beginning of this session by the Senator from Wisconsin (Mr. Sawyer). The Senator from Nebraska introduced a bill and the Senator from Kansas introduced one. Out of these three bills we hope to make one which will receive the sanction of the Senate.

Mr. Hale. Are they general bills?

Mr. Vest. It will be a general bill, providing that a public building shall be erected where it is necessary, under the suggestions of the Department, in towns having a certain population. I merely speak generally.

Mr. Hale. With a limitation of classification as to population?

Mr. Vest. We propose to classify them and get rid of this eternal importunity and log-rolling.

Mr. Hale. Such a bill would not get rid of it. We may pass all the general bills in the world and the individual case will still arise where the Department will want more money to complete the building.

Mr. Vest. When such a bill comes before the Senate, it will be possible for the Senator from Maine to turn his intellectual brain in that direction. If he and the Senator from Vermont will bend their

energies and investigation in that direction, for one I shall be exceedingly obliged to them.

Mr. Hale. It would not be of any use.

Mr. Vest. If the Senator will permit me, I will say just a word about my experience upon the Committee on Public Buildings and Grounds, and I personalize him because our relations are exceedingly friendly and have always been so. He wants a public building in the State of Maine, which, by the way, is the best supplied State in the Union in that direction.

Mr. Hale. Then I do not want the public building.

Mr. Vest. There are more public buildings, according to population, in that State than in any other State in the Union. The Senator wants a building in his State. He comes to me and says, perfectly justified by our social relations in doing so, that he is immensely interested in that measure, that, in other words, liberty will lie bleeding in the streets if he does not get it, and he solicits me to do what I can. He gets a report from the Supervising Architect, who says the public service demands it. He has a court there, an internal-revenue office, and, of course, a post-office. It would be churlish in me to say I would oppose his bill, and he knows better, perhaps, than myself — for his public service has been longer — in what a position a member of this or the other branch of Congress puts himself when he poses as a general reformer and obstructor to the expenditure of money for any purpose whatever.

Mr. Hale. Will the Senator let me interrupt him? I am greatly pleased with the imaginative sketch which has been presented by the Senator, and we are all of us pleased with those imaginative sketches of his, but I do not want it to go on record that I am in the position of beseeching the committee to increase an appropriation for a Maine building.

Mr. Vest. Not now. [Laughter.]

Mr. Hale. It happens that the one public building I have in my mind in Maine is perhaps what has called my attention to the subject I have just spoken of. I refer to the public building at the capital of the State, where the appropriation was ample for a large, handsome, suitable building for the business which will be carried on there, and yet there is an estimate for an urgency deficiency for a sum that surprises me, and I do not think it ought to have been sent in. So I am not in the position now of urging the Senator from Missouri to yield his virtue on the committee to my importunity.

Mr. Vest. I know that is the case.

Mr. Dawes. I wish to help the Senator from Missouri with my experience in the matter. If the Senator from Missouri knows, as he is very familiar with this great question, and will tell me how much the post-office building at St. Louis cost, I should like to give him a little history. Did it cost a million or a million and a half dollars?

Mr. Vest. Oh, that was not a circumstance. I think we spent three and a half millions upon it.

Mr. Hale. About five millions.

Mr. Vest. Yes; I could not state the amount accurately, but considerably over $3,000,000.

Mr. Dawes. I was on the committee in the other branch when the persons interested first came to Congress for a new post-office building in St. Louis. They said if they could have the old post-office building and $300,000, it might be bound as firmly as it could be in the law, they never would ask for another penny. Thereupon such a bill was passed. The Supervising Architect of the Treasury went out to St. Louis and they gave him a dinner. At that dinner it was announced that Cincinnati had a post-office building which cost a million and a half, that Chicago had a post-office building which cost six millions, and was St. Louis to be content with a post-office building that cost only $300,000? Not by a good deal, and the Supervising Architect of the Treasury assured them, in the face of the law, that they should have a post-office building equal to that of their rival cities. I understand my friend to say that it cost several million dollars. The law authorizing the post-office at New York had limitation put upon the appropriation as strong as it could be made. When it was commenced, the original act prescribed that it should be completed for a certain sum.

Mr. Beck. For $3,000,000.

Mr. Dawes. For $3,000,000, my friend from Kentucky, who remembers these things a great deal better than I do, says they came back for another million, and it was inserted in the bill at their request, so that they might be sure to have it, that the total cost should not exceed that limit. It exceeded that limit and they came for another appropriation. The same limitation was put in the law, and in the face of it, and with a standing law which makes it unlawful, indictable, impeachable, to exceed the limitations of an appropriation, it has gone on until $6,000,000 or $7,000,000 have been appropriated. The post-office building in Boston has run up into millions in precisely the same way.

Mr. Butler. How many millions?

Mr. Dawes. Three or four millions; I do not know how much.

Mr. Butler. About $9,000,000.

Mr. Dawes. They have never been able to be rewarded quite equal to some of their rival cities, but enough to indict every man who had any connection with the excess of expenditures over the limit of the appropriations. Until somebody is brought up under the law to realize that the law is made to be obeyed by officials, this never will be cured.

Mr. Teller. Is the building any too large now?

Mr. Dawes. It cost too much.

Mr. Call. Mr. President, I desire to say a single word. I have noticed that the spasms of economy always occur in regard to small States with a small representation. Where such a building as the one under consideration will cost $100,000, the great buildings in other States cost millions of dollars. We have passed several bills at this session appropriating more than a million dollars for a public building. I want this talk about economy to be expended upon those buildings and not upon a building of moderate cost, like the one at Pensacola, which the public business imperatively demands.

No one is to blame for this deficiency of $32,000 unless it is the contractor, who has to buy his supplies at varying rates, or the architect. You cannot make a law that the material which enters into a public building shall be the same price and value that it was when the estimate was made for the cost of the building. The architect is not to blame. If any one is to blame, it is Congress who votes the limitation. I do not know how my honorable friend from Missouri is going to pass a bill which will prevent future Congresses from appropriating as much money as they see fit for public buildings. But let that be as it may, it is Congress, it is ourselves, and not the Supervising Architect or the Secretary of the Treasury who are to blame for the extensions of the limit of the appropriations.

I wish to add that Pensacola pays a large amount of revenue to the Government. This building is imperatively demanded. The Supervising Architect certifies the fact that it will not be complete and useful for the purposes for which it was designed without this small amount of money.

Mr. Plumb. Mr. President, I want to indorse very heartily what the Senator from Florida [Mr. Call] has said about the place where economy is applied in legislation. New York got six or seven million dollars for a public building, and I noticed the other day that one newspaper in that city devoted an entire column to the abuse of Congress for the proposed expenditure of $50,000 or $100,000 upon public buildings in different parts of the country remote from New York. The cities get everything they want, without any reference at all to the cost, to the rental value of the buildings, or anything of that kind, and when they obtain it they then very coolly propose to close up the entire subject and have no more public buildings anywhere. It is a wrong tendency. It is a part of a general tendency to carry everything to the large cities at the expense of the country. It is not wholesome, but quite the reverse.

I think that wherever the Government has public business to transact of any magnitude it ought to have its own public building to transact it in, all the more because the absence of a building very often leads the Government, directly or indirectly, into real-estate speculations. The Post-Office Department had an inspector in Kansas during last summer who excited the acquisitiveness of the people living in different parts of towns interested in property, and so on, to bidding for the location of a post-office building, and he succeeded in getting, in places of 4,000 and 5,000 people, persons interested in real estate in certain parts of the town, not only to give the rent for perhaps five years for nothing, or at a merely nominal sum, say a dollar a year, or something of that kind, but to furnish the most elaborate fixtures for the use of the Government. I regard that as an offense. I do not think the Government ought to engage in business of that kind, and yet that is what it is doing. That is the reverse side of the picture which has been drawn here of the extravagance in public buildings in large cities.

But something has been said about the reasons for these deficiencies. Mr. President, it is the old story of a dollar for a dress and ten dollars for the trimmings. Every public building which is put up costs ten times more for superintendence and extras and contingencies than it ought to do. Out of $100,000 appropriated to erect a building, say, out in Kansas, at least $10,000 of that money will be spent before ever a lick is struck. There is the city of Wichita, where the Government has simply a naked lot. There is no more danger of its being carried away than of this Capitol being carried away, and yet it has a watchman and a superintendent, but no man at work.

Mr. Hale. They are watching the land.

Mr. Plumb. Yes, they are watching the land. I do not know but that they are watching the Republican politicians out there. At all events, the watchmen are there and they are getting paid for it. The Senator from West Virginia [Mr. Kenna] says to me that the Republican politicians there need watching. If they do you will have to appoint a great deal more clever people than you have done out there in order to make that watching very effective.

Mr. Kenna. The Senator entirely misunderstood my remark, if he alludes to me. I said there were no other kind of politicians out there to be watched.

Mr. Plumb. I have in my hand the report of the commission for the construction of the Congressional Library building, which has in it some paragraphs which are a sample of that which pertains to the construction of every public building in the United States. It shows that we are getting a large amount of services of architects, a large amount of washing of towels and hiring of coupés and things of that kind, and a very little building. During the last year there have been spent for literally contingent items in no wise represented in the construction over $38,000.

Mr. Hale. On that building?

Mr. Plumb. On that Library building. The Senator from Massachusetts [Mr. Dawes] seeks to identify it by saying that it is

where the hole is. The hole is there, and before it ever assumes the pretense of a construction it will be big enough to carry into it more than the sum of money we intended to appropriate for a building. I will commence on page 14, at the bottom of the page, and read from the report of the Commission for the Construction of the Congressional Library Building:

Office expenses:	
Stationery, draughtsmen's tools, materials and instruments, and printing and binding, etc.	$1,821.15
Office-furniture, drawing-boards, cases, awnings, etc.	2,612.16
Office expenses — Continued.	
Fitting up offices, 145 East Capitol Street	1,954.17
Blue-print room	919.66

It will be noticed that all these sums have accommodating fractions as an affix, which, of course, are supposed in some way to verify them.

Fuel and gas	261.51
Laborer as janitor	573.00

The Senator from Massachusetts [Mr. Dawes] is now seeking to introduce some irrelevant matter here by inquiring what that man is janitor of. He is janitor, I suppose, of what the man out in Wichita is watchman of.

Mr. Kenna. Of the hole in the ground?

Mr. Plumb. Of the hole in the ground. The report continues:

Coupé, two horses (one to replace horse sold, and proceeds covered into Treasury), harness, robe and blankets	$868.00	
Livery bills for carriage and horses, driver, and repairs	540.49	
		$1,408.49
Washing towels,		35.11

It is something to be clean at Government expense.

Notary's Fees	.75
Cleaning windows, putting away fuel	25.30
Lanterns and oil for watchmen	11.25
Making models for architect, labor	216.00
Express and freight	1.08
Miscellaneous supplies	54.07

The items foot up $9,893.80.

Those are all, as will be seen, items with some particularity and some detail. Now we come to some other expenses, in which the clerk-hire apparently gave out, and consequently there are no items at all; they are continued in a lump. This is in the Commissioner's office:

Salaries and pay of office employés:	
In Commissioner's office —	
Secretary, accountant, disbursing agent, and messenger	$5,639.00
In Architect's office —	
Architect, assistant architect, computer, civil engineer, experts, draughtsmen, clerk, messengers, and sculptor	23,200.80

I suppose they are set down in the order of their relative importance and rank. I can readily see how a sculptor would not be necessary for the purpose of executing a hole in the ground, at least not a sculptor of very high degree. These items sum up $23,200.80, making a total for salaries and pay of office employés of all kinds that are mentioned of $28,839.88. In other words, the personal staff, not of a Library building, not of a piece of public work in process of execution, but the personal staff of something that is not being done at all, cost last year $28,839.88. And they had besides, in the way of contingencies, frills, and furbelows, coupés, and things of that sort for their convenience and comfort, $9,893.80, making, as I said, a total of over $38,000, which has been spent without yielding to the Government one single return, except the happy satisfaction we all of us have of seeing a man walking around, well dressed, at the public expense, and knowing that we have contributed to his comfort and convenience and to the general air of well-fedness with which he exhibits himself.

A Senator has handed to me an itemized statement which appears in the Blue Book. Here is the Blue Book itself, which sets forth the names of the different employés under the commission which has been created by law for the purpose of spending the money which we have appropriated to construct a Library building. Sub-titles are put in to indicate the particular employment of the different persons engaged, and under the title of "In charge of horses and carts" I find the following names:

Samuel Brown, District of Columbia —

He was appointed from the District of Columbia; they were all appointed from the District of Columbia, however —

Mrs. Amelia Johnson.	Bartley Thornton.
Mrs. Almyra Burgess.	Daniel Toumey.
Mrs. Mary Liberty.	Mary E. Shearer.
Patrick Powers.	Maurice Talty.

There is nothing recorded there that is very remarkable, but still it is worth pausing to consider that four women are put down as in charge of horses and carts. Of course it may well be that as these women did not have any voting to do, being withdrawn from the discharge of the very onerous public duty of casting a ballot, they have more time to give to the discharge of the very useful duty of taking care of the horses and carts which the commission employs although just what the horses and carts are for of course I do not know. The man who said in a public meeting that he vouched for a certain man was a little disconcerted when somebody stepped up and asked, "Who vouches for you?" I am not vouching for the horses, nor for the carts, nor for the women in charge of them, and I do not care to suggest that some sort of subterfuge has been employed whereby persons are put on the rolls to do one thing, perhaps of a somewhat personal character, while at the same time they are exhibited as performing a public duty.

But it is plain to be seen that we are not going to get anything out of the appropriation of money for a library except a large bill of expense and I do not speak of this particularly for the purpose of characterizing it alone, but of saying that in the Architect's Office of the Treasury Department will be found the data to show that in substantially all the public buildings already erected by the United States and being erected now a similar condition of things exists, and it is one reason why the Government pays from twenty-five to fifty per cent more for a given result than private parties pay. The moment a public building is provided for, it becomes a sort of hospital for persons who want employment, and long before any contract is made or the Government has got any property to watch or look after, somebody is appointed as a superintendent. It does not make any difference how long the construction may take, the superintendent is like the brook, he goes on forever and forever.

I have been asked who constitute the Library Building Commission. I know that the Secretary of the Interior is *ex-officio* president of the Board; that it consists of an architect, who drew the plans, and of the Architect of the Capitol, certainly. I do not know who else.

Mr. Butler. And the Librarian of Congress.

Mr. Plumb. Yes, the Librarian of Congress. There being two architects on the Board, of course they do not agree, except presumably in regard to the expenditure of the money, and of course, therefore, there has grown up all sorts of trouble, one pulling one way and one the other, and nobody at hand to put the casting ballot on one side or the other, and the result is, probably what was designed, a simple wasting of the public money, a nursing of that building in order to give employment to the end of time. Certainly there is in that commission, so far as the majority of it is concerned, no honest purpose to complete the building within the contemplation of the Act of Congress.

I do not say where the responsibility should rest for that condition of things, because I do not know, but the majority, which has the power to resolve all these things in favor of prompt, active work of construction, has not chosen to do so; but, on the other hand, there is a great expenditure for employés entirely unnecessary, for contingent expenses which are extravagant when no work of construction is going on, and that is a sample of the way the public business of the country is transacted to a very large extent in regard to public buildings. The money which has been wasted in this way would have supplied to every town of 25,000 people in the United States a building large enough for the transaction of the public business; it would have enabled the Government to have in all these cities and towns an abiding place, some place where its jurisdiction was supreme, some place where its public business could be transacted to-day and to-morrow and for all time, and a guaranty that the Government itself would not be, either actively or negatively, wilfully or ignorantly a party to real-estate speculations.

Mr. Stewart. Mr. President, I am glad there has been a statement of the transactions to which allusion has been made, and I think from conversation with the architect there is certainly reform needed. In my town an appropriation was made some years ago of $100,000 for a public building. They hardly got started when $20,000 had been spent with only a fence around the lot and the expense going on. This occurred under a former administration of the bureau, and I am very much in hopes and I believe that the present incumbent will try to make a thorough reform and go on with the business properly and erect the buildings with the money, which, as I understand, was not done in the case to which I refer until one-fifth of the approportion was spent.

Mr. Edmunds. When was the appropriation made?

Mr. Stewart. I do not remember the exact date, but three or four years ago. They had a great deal of trouble in getting a location, but finally they got one that was satisfactory to the Department, but it cost ten or twelve thousand dollars, and eight or ten thousand dollars more had been spent in preliminaries, such as a high fence, a superintendent, and so on.

I am quite confident that the present Supervising Architect is going on with the work, and that he will have reform generally in this business. If he does not, we shall all have reason to complain. I would not like to have reflections cast upon a man just coming in with good intentions and making effort to do what is right. Give him a chance. A distinction ought to be drawn between the man who has failed and the man who has come in with the intention of doing right, as I think the present Supervising Architect intends to do.

Mr. Vest. I have no disposition to retard the passage of the Bill of the Senator from Florida, because, as I said before, it is a deserving measure and ought to be passed; but I noticed in this debate the Senators who have engaged in it have undertaken to state the difficulties under which we have suffered, but none seem to have pointed out the radical defect in the system under which we have constructed public buildings.

Mr. Stewart. The Senator will excuse me. I meant to remark before I sat down that I believe the appropriation in this Bill is a necessary appropriation under the circumstances, and I shall vote for it cheerfully.

Mr. Vest. In the first place the same trouble exists in regard to the construction of public buildings that we encounter in the Indian service. We have heard for years the question asked, why is it that the Indian service of this country is in its present condition? Why is it that thousands and thousands of dollars are expended by Congress and the Indians are no better off, and the country is no better

off? And the same evils exist and will exist as long as this system continues. The truth is, we expect too much first-class service for the lowest possible amount of money. We send a man to take charge of a tribe of Indians, and pay him a thousand dollars, $1,200, or $1,500 a year. He is expected to control human beings; he is expected to perform the most delicate and responsible functions that can be given to any human being — the control of others as to their life and habits — and yet we pay a thousand or $1,200 a year; and a man is expected to leave civilization and endure the hardships of the frontier and associations with savages, to give up all that makes life worth anything for a miserable pittance that he would ask any clerk to give his services to the Government for here or anywhere else.

We expect to get a first-class architect for $3,500 a year. Why, sir, there is not an architect in the city where I live, who is worthy the name, who is not making from ten to fifteen or twenty thousand dollars a year. I undertake to say in the city of Washington to-day there are half a dozen architects making over $10,000 a year. I asked a gentleman the other day, one of my colleagues in the Senate, who recently constructed a large building, an eleemosynary institution, what amount he had paid the architect. He said $15,000 — nearly five times the salary in one year that we give to our public architect for a year's service. However worthy the present incumbent may be, it is perfectly absurd to suppose we can secure the services of a man competent to take charge of the public buildings of the United States for any such salary.

Then, again, that is not all the trouble. We have this miserable system of day's work. We give a premium to every man, contractor, architect, workman, down to the laborers on the public buildings, to continue the work just as long as possible. The first step when we pass a bill appropriating money for a public building is to send an architect there, and he employs two watchmen and a clerk, and has a model-room and all the paraphernalia of a large business.

Mr. Edmunds. And a local superintendent.

Mr. Vest. And a local superintendent. The salaries go on, and when the building is finished those fellows are out of work. We put a premium upon delay; we have done it for years.

The Senator from Massachusetts spoke of the public building at Chicago. There is a building that went on for years and cost four times what Congress originally intended, and now it is ready to fall down, condemned by the grand jury as a public nuisance, and the evidence in regard to the construction of that building is, I will not say horrible, it is the most disgusting that ever was printed on any public subject in the United States. I have not read it for some time — I have it somewhere among my papers — but it showed that they absolutely organized laborers upon the public buildings so as to cheat the superintendent. They had a society organized, and when the men would be down playing cards, gambling, there were watchmen out to give notice of the approach of the superintendent and the game was broken up, and when he arrived there every man was at work, and the minute his back was turned every man was gambling again.

Mr. President, as long as this system continues we may expect exactly what is the condition of the country to-day. Two years ago the Committee on Public Building and Grounds reported a bill to do away with this system and to put it under contract and let the public buildings of the country be constructed as any private gentlemen would construct his residence. There is not a Senator on this floor to-day if he was about to construct a residence in the city of Washington, who would not call upon architects for their plans and specifications, and then take bonds of a contractor for the erection of the building according to those plans and specifications in a given time.

Mr. Edmunds. And within a given price.

Mr. Vest. And a given price. And if it were not completed the forfeiture would be exacted on the bond. And yet what do we do in regard to the money of the people of the United States put in these public buildings? We take no bond. There is a little paper here in the city of Washington, as big as my two hands, or was here — I have not seen it lately — which lives upon the advertisements from the Treasury Department for public buildings.

When a bill was passed in Congress for the construction of a building in Missouri the bids were put out for the different sorts of work in this little paper. A ring was here in the capital and this work was confined to that ring, and no man received one dollar who was not in it. It was upon the face of the statute-book the duty of the Secretary of the Treasury to supervise these contracts, but as a matter of course they went to the Supervising Architect's Office, as a matter of routine, and the Secretary of the Treasury knew no more about them than any Senator in this body.

Does any one wonder that public architects went out of this city almost millionaires who came here paupers? Is it any wonder that a few years ago the newspapers of the country were filled with the scandal in regard to the public architect's office that threw one man out of office and implicated several others? All these things have taken place, and they will take place until we reorganize the whole system under which the public buildings are constructed. The bill to which I referred was reported two years ago and received no more attention from Congress than a piece of blank paper. Nobody cared anything about it, but on the other hand — and I do not put myself on a pedestal to lecture my brother Senators — in the rush to have public buildings constructed in different localities, the general law was permitted to die, and it amounted to nothing.

Mr. Edmunds. What did that general law provide in substance?

Mr. Vest. It provided that when a public building was to be constructed bids for the work should be advertised in the newspapers having the largest circulation in the city and vicinity where the building was to be constructed; that those bids made by responsible persons should be submitted to the Secretary of the Treasury and the Secretary of War and the Secretary of the Interior; that they should meet and pass upon the bids, and when they awarded them to the lowest responsible bidder he should then give bond with approved security for the construction of the work within a certain time at a certain price. In my opinion we shall never be able to do away with the abuses that exist until that bill or some similar measure is enacted. As we are now proceeding there can be no reform.

I make these remarks with no political significance at all. I say that the business of the people of the United States should be conducted upon business principles; and there is not one Senator here to-day who would for a single moment think of applying the system that now prevails in this country to his own private business.

Mr. Hale. Mr. President, it strikes me that there is a good deal of force in what the Senator from Missouri has observed in reference to the inadequate compensation the Government pays to the officers who have this great business of the public buildings in charge. The pay is not commensurate with the importance of the place; of that there can be no doubt. And yet bright and competent architects are always very well pleased to be connected with this work, and especially to hold the position of Supervising Architect of the Treasury, under which most of this work is done. The enlarged experience, the broad acquaintance that is made, and the reputation that may naturally follow a man's successful course in this office, give him a great advantage when he leaves the office and returns to the field of private competition; and the history of this office has been for years that the men who have left it have gone into their old vocation in private life benefited undoubtedly by this experience. So that is to a degree an offset against the poor pay that we give them.

What I wish especially to call attention to — because, as I said before, the Senate has got to meet it — is the call that is made upon us now from the Supervising Architect's Office and from the Treasury Department for money appropriations in excess of the limit heretofore fixed by Congress. For this I do not blame the present Architect. I have had but little business to do with him since he came in, and that business has impressed me favorably with him personally. But for the first time Congress is confronted with this condition in regard to the public buildings throughout the country. Everybody knows that for years past as a building in a particular place neared its completion its friends and the representatives of the community where it is being built appear in Congress, either in the other branch or here, and seek to remove the limit and to get an increased appropriation; but it is only of late that the Department itself having charge of this work, limited by the decree of Congress in fixing the limitation on the several buildings, has adopted as an estimate of an actual deficiency for the current year the claims that are set up for increased expenditure.

The advocates of the buildings, the Representatives of the districts or the Senators from the States, are not left as heretofore to fight it out on the floor of either the one House or the other in Congress and get their increase if they can, but the Department, disregarding the limitation fixed by law, has adopted these estimates for deficiencies.

I hold here now a document which is headed, not "ordinary deficiencies," but "urgent deficiencies," deficiencies that press, deficiencies that must needs be inevitable, upon which speedy attention is demanded, and the heading, further, of the estimates is in this language:

Estimates of deficiencies in appropriations required to meet urgent demands of the Government for the fiscal year 1888, and for prior years —

Not to be embraced in the general-deficiency appropriation bill, where we have formerly put such items, if put at all, but in the urgent-deficiency bill that hangs as a menace over Congress, that if it does not promptly treat the subjects that are called for in this document great harm will result to the public service; and here are the items on the subject about which we are talking; I will read them in alphabetical order:

Auburn N. Y.: Post-office, Court-house, etc. —
For completion, in excess of the limit $30,000

Mr. Edmunds. Where do those estimates come from?

Mr. Hale. From the Treasury Department, and sent down with this heading, indicating that they are urgent, not ordinary deficiencies.

Augusta, Me. —

The building to which I before referred.

Augusta, Me.: Post-office, Court-house, etc. —
For completion, in excess of the limit..... $35,000

Whenever that is reached upon any appropriation bill, I shall have something to say as to the reasons that have caused this deficit in that appropriation, this request for $35,000 more money than was originally appropriated, when all that was asked for was given.

Buffalo, N. Y.: Custom-house and Post-office —
For completion, in excess of the limit..... $500
Carson City, Nev.: Court-house, Post-office, etc. —
For completion, in excess of the limit..... 36,000
Charleston, S. C.: Custom-house wharf —
For extension and completion, in excess of the limit..... 138,000
Concord, N. H.: Post-office, Court-house, etc. —
For completion, in excess of the limit..... 11,000
Dallas, Tex.: Court-house, Post-office, etc. —
For completion, in excess of the limit..... 11,000

Denver, Col.: Court-house, Post-office, etc. —	
For extension and completion, in excess of the limit	$60,000
Fort Wayne, Ind.: Court-house, Post-office, etc. —	
For completion, in excess of the limit	16,000
Hannibal, Mo.: Post-office, etc. —	
For completion, in excess of the limit	2,000

Mr. Beck. While the Senator is going on with that, as I am not well enough advised about it, I ask him whether many of those things do not arise from the fact that under previous contracts, until a new ruling by Secretary Fairchild, the house was considered completed when the building was roofed, or regardless of the approaches. Those old contracts were made on that basis, and the building was called complete when the work on it was done. A late ruling requires that the approaches shall all be embraced and made part of the contract, and, therefore, under the late ruling, whenever a building was finished and the heating apparatus and the approaches are not completed, there would be a deficiency. Is not that the case?

Mr. Hale. I happen to know about that. In small sums that is true, and the decision undoubtedly in such cases has helped to swell this estimate, but it only applies in a limited amount. For instance ——

Mr. Beck. One more suggestion and I am done. Perhaps we shall get some good out of this talk when we come to regulating the matter hereafter. Is it not the fact when a force is employed of watchmen, clerks, messengers, and I do not know what they call them, that they are always paid and kept under pay until the last brick in the pavement is laid all around, and all the approaches are finished?

Mr. Hale. Undoubtedly.

Mr. Beck. That has been stopped, has it not?

Mr. Hale. All of this is an old practice, but never so great, I think, as at present in its abuse; but still it is an old practice, coming down somewhat from the past, and in estimating what the limit shall be originally in the architect's office, which limitation Congress accepts, all of these things are included.

Now, the consideration about heating apparatus, approaches, etc., which are held under the decision of the Treasury to swell the cost, only applies in a small degree, and it cannot apply excepting in the case of a building nearly completed. In the case of the building at Augusta, Me., where it is only just begun, it has already been found that under the management, or mismanagement, there, they are $35,000 short, and in addition to that they have another estimate in for fireproofing the building.

In addition to that, which I did not read, take the work at Charleston, $138,000. That is not in any way increased, or to any material extent, by the consideration suggested by the Senator from Kentucky. No, it is the deliberate adoption on the part of the Department of this cry for more money over and above the limit fixed for the building, when I think it would have been better administration if the Department had said, "Congress has given us a rule in these buildings; Congress has fixed a limit; if Congress removes the limit, then we will estimate as to what more is needed to complete the buildings"; but I do complain that Congress is called upon now by the Department as an urgent deficiency to increase these items. Let me continue reading:

Jackson, Tenn.: Court-house, Post-office, etc. —	
For completion, in excess of the limit	$ 1,000
Keokuk, Iowa: Court-house, Post-office, etc. —	
For completion, in excess of the limit	15,000
Leavenworth, Kans.: Court-house, Post-office, etc. —	
For completion, in excess of the limit	3,000
Lynchburgh, Va.: Court-house, Post-office, etc. —	
For completion, in excess of the limit	2,000
Manchester, N. H.: Post-office, Court-house, etc. —	
For fireproofing and completion, in excess of the limit	46,000
Montpelier, Vt.: Post-office Court-house, etc. —	
For completion, in excess of the limit	20,000

I am informed that in the latter case, where it is already settled by the Department that the limit is to be exceeded, hardly a stone or brick has been laid.

Pensacola, Fla.: Court-house, Post-office, etc. —	
For completion, in excess of the limit	$ 2,000
Port Townsend, Wash.: Custom-house, Post-office, etc. —	
For completion, in excess of the limit	38,000
Poughkeepsie, N. Y.: Post-office, etc. —	
For completion, in excess of the limit	500
Richmond Va.: Custom-house, etc. —	
For completion, in excess of the limit	33,000
Rochester, N. Y.; Court-house, Post-office, etc. —	
For fireproofing and completion, in excess of the limit	50,000
Shreveport, La.: Post-office, Court-house, etc. —	
For plumbing and completion, in excess of the limit	2,000
Springfield, Ohio: Post-office, etc. —	
For completion, in excess of the limit	15,000
Syracuse, N. Y.: Post-office, Court-house, etc. —	
For extension, granite-work for approaches, and completion, in excess of the limit	65,000
Terre Haute, Ind: Post-office, etc. —	
For completion, in excess of the limit	32,000
Toledo, Ohio: Custom-house, Court-house, etc.: —	
For completion, in excess of the limit	17,000

And the aggregate is $796,500 in an urgent-deficiency estimate. What the conditions are that have changed from the conditions of the past that should justify this urgent demand upon Congress to change what is substantially the law in twenty or thirty different cases, enacted by Congress, I fail to see. That there has been solicitation most abundant and overpowering before the Department I can well conceive; but, as I have said before, it occurs to me that it would have been better administration if the Treasury Department had said, "There is the written law; there is the statute enacted by Congress that authorizes the building of this structure, and until Congress declares that the limit fixed therein shall be exceeded or changed the Department administering the law passed by Congress will not step one foot beyond the boundary of that law. Get your limitation increased by Congress, gentlemen, and then the Department will estimate the cost upon plans that it will submit."

I hope, Mr. President, that this is not an adoption of a new rule of action in the Department under which, at the beginning of every session of Congress, we shall have claims put in here, or estimates made here for what are called urgent deficiencies of this kind, and the subject to me is so important that I have been glad that the Senator from Vermont has raised the question upon this Bill which, as I have said, I know but little, or nothing in fact, about, in order that these facts might be presented.

Mr. Teller. Mr. President ——

Mr. Morrill. Will the Senator from Colorado, before he proceeds, allow me to read the phraseology which has been inflexibly adopted by the Committee on Public Buildings and Grounds in relation to all of these buildings which have been authorized. I read from a Bill that was passed last session for Springfield, Mass.:

> That the Secretary of the Treasury be, and he is hereby, authorized and directed to purchase a site for, and cause to be erected thereon, a suitable building, with fire-proof vaults therein, for the accommodation of the United States post-office, internal-revenue office, and other government offices, at the city of Springfield, Mass. The plans, specifications, and full estimates for said building shall be previously made and approved according to law, and shall not exceed for the site and building complete the sum of $150,000.

That is the precise formula that has been adopted for years, and so far as the Committee on Public Buildings and Grounds are concerned they have made the law as stringent as possible.

Mr. Hale. And was it not the expectation in this case as in every other that the building when completed should be confined to the limit fixed by the committee and then by Congress.

Mr. Morrill. Of course it was.

Mr. Edmunds. And put in working operation.

Mr. Spooner. I should like to say, by way of supplementing what has been said by the Senator from Vermont [Mr. Morrill], that in the bills which have been reported by the Committee on Public Buildings and Grounds at this session we have incorporated a provision that the erection of the building shall not be commenced until the plans have been completed and approved according to law, and the estimates fully made and submitted and approved upon the basis fixed in the law.

Mr. Teller. Mr. President, several years ago, I should say at least six years ago, perhaps seven, Congress appropriated $300,000 for a public building at Denver. That was a very small sum for a place that promises as much as Denver. From the time the appropriation was made to the time that the building had got up to the level of the street, which was somewhere in the neighborhood of two or three years — I do not remember just exactly what — the population of the city had doubled, and before they ever get the roof on, if they should ever succeed in doing so — and that is let by contract and not being done by day's work — or even before they get the joists in the first story, there will be three times as many people in Denver as when Congress passed the law.

After the bill had been passed and the plans had been prepared and the building had been laid out on the ground and the cellar dug, or the basement, or whatever it is, and the United States officials began to look at the size of the rooms, they discovered that they were ridiculously small and entirely inadequate to the business. Thereupon at the last session of Congress the limit was raised from $300,000 to $575,000, and preparation was made for the enlargement of the building correspondingly. This could be done at that time without any waste of money, except the waste that might be incurred in having the watchman, etc., who are spoken of. The basement walls were so thick that they could be increased without adding materially to the expense, without taking them up, and they were left there; so that there was practically no expense. After all this it was discovered that the building was still not large enough. It is a notorious fact that Denver is full of people, and the post-office establishment is in a very small room, crowded with people, who stand around waiting for their turn to get into line, and the post-office officials declare that the building will be entirely inadequate for the increased amount of business. I will not undertake to state here now what the business of the Denver post office is, but it is at least three times that of any city of equal size in any of the New England States.

Mr. Edmunds. What is the population now?

Mr. Teller. Seventy-five thousand, probably; and you can readily see how that is. In the first place you have a system that enables our wives and daughters in Colorado to send to New York and New England to buy their dry-goods and have them sent by mail. They do that. Then the city is always full of strangers, who go to the office for their mail. As I say, men stand for hours now sometimes to get to the window that they may get their mail. So, of course, there is necessity for more room, as the officials say.

It is the suggestion of the Department that in the rear of the building now being constructed on the main travelled street of the city we can extend it for $60,000, so as to add to the area of the building on the first floor 28 feet by 110. That will cost $60,000, and that will make an efficient and valuable post-office; and without it they will have a post-office that never will be large enough for the town.

But is there not some fault here when we commence so inadequate a structure for a town like Denver that everybody knows, who has given the least attention to settlements in that country, must be a

great town some day — 600 miles from any public building, 600 miles from where the Government had ever put a dollar for the benefit of the people of that western country, and the only building you put in Colorado except the penitentiary that you erected for the Territory some years ago for the moderate sum of $28,000, which ultimately, of course, fell to the State.

I say that the appropriation of $575,000, with $60,000 added, is not an improper appropriation for the city of Denver. It is not now what it ought to be by three or four hundred thousand dollars, and no money will be wasted by this appropriation, and none has been wasted there. It is standing there without anything having been done with it, because last year the enormous appropriation was made for that building of $25,000, and it was so small that the contractors declined to go on, as they ought to have declined.

Mr. Hale. Why did you not get more?

Mr. Teller. I had more appropriated in the Bill, but when it got into one of the conference committees, that no man living outside the committees ever understood the intricacies of, it was juggled out in some way [laughter], and instead of coming out $115,000, it came out $25,000. I was not astute enough to discover it until several months after the Bill had become a law, neither was my colleague, nor was the gentleman who represented the State at the other end of the Capitol. We did not discover it until it was too late. So there it stood, and it will not be any special credit to the Government when it is built. There will be plenty of private buildings in the city of Denver that cost more money, that are of more value, and are more imposing in structure and better adapted to the purposes for which they were built than this, and the Government of the United States will, undoubtedly, when it has got this building, be the most poorly furnished of all those doing business in that great city.

Mr. Hale. Now, will the Senator allow me?

Mr. Teller. Certainly.

Mr. Hale. He is furnishing a complete illustration of the evils that I have been complaining of. Granted that Denver is entitled to and should have for a public building a structure that costs not only five, or six, or eight hundred thousand dollars, the Senator has named so good a case showing that the limit should be increased that had it been presented to Congress which fixed the limit, and not to the Department, he would have had no trouble in securing an extension of the limit.

What I complain of is, that after Congress has once increased the limit of a building like this, or in this case, then the Secretary goes on, and, as an urgent deficiency, calls upon Congress to appropriate $60,000 additional. That the money may be needed there on that work after Congress shall have passed upon it, I do not question; but it is beginning at the wrong end; it is putting the cart before the horse. Congress should pass upon these questions. If it pretends to fix limits it ought to unfix limits, and nobody else ought to do it. I do not make any question about the situation in Denver.

Mr. Teller. I am inclined to agree with the suggestion of the Senator, which implies at least that when my bill gets here he is going to vote for it; but I have had some experience in this body, and have had some experience with raising the limit of this building, and I know how difficult it was to get it from $300,000 to $575,000. I knew I could not get the limit raised any higher unless I got the approval of the Department, and I went to the Department for the purpose, and I suppose this perhaps arises out of the complaints made by our people and my representations to the Department. If they say now that in their judgment, the judgment of men charged with the erection of this building, $60,000 more ought to be appropriated — the building is in an unfinished state, the building is now in a proper state to be enlarged without any waste of money to the Government — I do not see why it cannot just as well come in that way as to come in the shape of a special bill, which must run the gauntlet of the committees and then of the other House. Besides, we have a bill before that committee now for a town of twenty-odd thousand people, where there is a United States court, where there is a United States revenue collector, and all the officers of the Government, and we have not yet got any response from the committee, and I am fearful we shall not get any. I would rather see this appropriation go through on the urgent-deficiency bill than to take the risk of any separate bill, although, of course, if I cannot get it through there I shall be in favor of the bill.

I only wanted to say that there has been no misappropriation so far as this building is concerned, there has been no extravagance, there has been no demand for a building beyond the wants of the community and the Government; and when the building is completed with the $60,000 added, it will not be big enough for the business of the United States Government in the city of Denver.

Mr. Edmunds. Mr. President, without any prejudice to the bill of the Senator from Florida — there must be further discussion — but without any particular reference to that bill, it is extremely desirable that there should be an executive session, and I move that the Senate proceed to the consideration of executive business.

. . . . . .

Mr. Call. I hope the Senator from Vermont will allow us to dispose of the Bill. . . .

Mr. Edmunds. In order to have this whole subject disposed of, I was about to suggest a unanimous understanding that we take this Bill up in the morning hour on Monday, as I wish to say something more myself on the general subject; but as the Senator from Florida is anxious about it, and this is only one little bill, if we can get a vote without further debate, I will withdraw the motion for an executive session.

The President *pro tempore*. The question is on the amendment reported by the Committee on Public Buildings and Grounds.

The amendment was agreed to.

The Bill was reported to the Senate as amended, and the amendment was concurred in.

The Bill was ordered to be engrossed for a third reading, read the third time and passed.

THE ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE BASILICA, QUEBEC, CANADA.

[Gelatine print, issued only with the Imperial Edition.]

T-SQUARE CLUB COMPETITION. DESIGN FOR COUNTRY STABLE. MR. WALTER COPE, ARCHITECT, PHILADELPHIA, PA.

THIS design received first mention in one of the regular competitions of the Club. The programme was as follows: A design for a country stable to accommodate three horses and two cows, required a plan at one-eighth scale and a perspective rendering with pen or brush.

STATION AT COMO, MONMOUTH CO., N. J. MESSRS. COPE & STEWARDSON, ARCHITECTS, PHILADELPHIA, PA.

THIS station was built last summer at a cost of about $7,000. The materials are broken range brownstone, 6′ 0″ high, red brick above, roof slated.

DESIGN FOR BARNES HALL, CORNELL UNIVERSITY, ITHACA, N. Y. MESSRS. ROSSITER & WRIGHT, ARCHITECTS, NEW YORK, N. Y.

THIS was a design made in a limited paid competition. The successful competitor was W. H. Miller of Ithaca.

FIRST PREMIATED DESIGN FOR THE PROPOSED YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, PROVIDENCE, R. I. MESSRS. STONE, CARPENTER & WILLSON, ARCHITECTS, PROVIDENCE, R. I.

THE AMENDED DESIGN FOR THE SAME BUILDING.

THE principal changes are in the increase in the size of the main hall, in the number of class-rooms, and in the re-arrangement of the rooms in the first story.

HOUSE FOR A. N. ELLIOTT, ESQ., CHESTNUT HILL, PHILADELPHIA, PA. MR. J. C. WORTHINGTON, ARCHITECT, PHILADELPHIA, PA.

HOUSE NEAR ST. LOUIS, MO. MESSRS. EAMES & YOUNG, ARCHITECTS, ST. LOUIS, MO.

SAFE BUILDING.—XXIII.[1]

Lateral Flexure in beams. IN using iron and steel beams it is very important that they be supported sideways, so as not to yield to lateral flexure. Where the beams are isolated and unsupported sideways, the safe load must be diminished. Just how much to diminish this load is the question. The practice amongst iron workers is to consider the top flange as a column of the full length of the span, obliged to yield sideways, and with a load equal to the greatest strain on the flange. Modifying therefore, Formula (3) to meet this view, we should have:

[1] Continued from page 56, No. 632.

Beams not braced sideways.

$$w_1 = \frac{w}{1 + \frac{y \cdot L^2}{b^2}} \qquad (78)$$

Where w_1 = the safe load, in pounds, on a beam, girder, lintel or straight arch, etc., unsupported sideways.

Where w = the safe load, in pounds, on a beam, lintel or straight arch supported sideways.

Where L = the length of clear span, in feet, that beam, etc., is unsupported sideways.

Where b = the least breadth in inches of top flange, or least thickness of beam, lintel or arch.

Where y = a constant, as found in Table XVI.

(In place of w we can use r = the moment of resistance of beam supported sideways, and in place of w_1 we use r_1 = the moment of resistance of beam *not* supported sideways.)

The above practice, however, would seem to diminish the weight unnecessarily, particularly where the beam, girder, etc., is of uniform section throughout; for while the beam in that case, would be equally strong at all points, it would be strained to the maximum compression only at the point of greatest bending-moment, the strain diminishing towards each support, where the compression would cease entirely. To consider therefore the whole as a long column carrying a weight equal to this maximum compressive strain, seems unreasonable. Box has shown however that the maximum tendency to deflect laterally is when we consider the top flange (or top half in rectangular beams, lintels and straight arches) as a column equal to two thirds of the span (unsupported sideways) loaded with a weight equal to one-third of the greatest compressive strain at any point. This greatest compressive strain is always at the point of greatest bending moment, (usually the centre of span) and is equal to the area of top flange, multiplied by $\left(\frac{c}{f}\right)$. In case of plate girders the angle-irons and part of web between angle-irons should be included in the area. Box's theory is given in Formula (5); if then we take one-third of this "maximum tendency to deflect" as safe, we should have the same Formula as (78) but with a smaller value for y. The

Use of Table XVI.

writer would recommend using the larger value for y, where, as in plate girders, trusses, etc., the section of top flange or chord is diminished, varying according to the compressive strain at each point; and using the smaller value for y, where the section of beam, girder or top chord is uniform throughout.

TABLE XVI.

VALUE OF Y IN FORMULA (78).

Material of beam, girder, lintel, straight arch, etc.	Value of y for girders, beams, etc., of *variable* cross-sections.	Value of y for beams, girders, lintels, straight arches, etc., of *uniform* cross-section throughout.
Cast-Iron	0,5184	0,2304
Wrought-Iron	0,0432	0,0192
Steel	0,0346	0,0154
Wood	0,5702	0,2534
Stone	3,4560	1,5360
Brick	5,7024	2,5344

Thus the $10\frac{1}{2}'' - 90$ pounds beam at 20 feet span will safely carry (if supported sideways) a uniform load of 5,9 tons or 11,800 pounds (see Table XV.) The width of flange being $4\frac{1}{2}''$, and this width and its thickness, of course, being uniform throughout the entire length of beam, we use the smaller value for y (second column) and have for the actual safe uniform load, if the beam is not secured against lateral flexure:

$$w_1 = \frac{11800}{1 + 0{,}0192 \cdot \frac{20^2}{4\frac{1}{2}^2}} = \frac{11800}{1 + 0{,}379}$$

$$= \frac{11800}{1{,}379} = 8557 \text{ pounds, or } 4{,}28 \text{ tons.}$$

Had we used the larger value for $y = 0{,}0432$ we should have had

$$w_1 = \frac{11800}{1 + 0{,}854} = \frac{11800}{1{,}854} = 6365 \text{ pounds, or } 3{,}18 \text{ tons,}$$

which closely resembles the value (3,29) given in the Iron Companies hand-book, but is an excessive reduction under the circumstances.

Doubled Beams.

Where two or more beams are used to carry the same load, as girders for instance, or as lintels in a a wall, they should be firmly bolted together, with cast-iron separators between. In this case use for b in Formula (78) the total width, from outside to outside of all flanges, and including in b the spaces between. The separators are made to fit exactly between the inner sides of webs and top and bottom flanges. The separator is swelled out for the bolt to pass through. Sometimes there are two bolts to each separator, but it is better (weakening the beam less) to have but one at the centre of web. The size of separators and bolts vary, of course, to suit the different sizes of beams. They should be placed apart about as frequently as twenty times the width of flange of a single beam. Where beams are placed in a floor, the floor arches usually provide the side bracing. But in order to avoid un-

Tie-rods.

equal deflections, and possible cracks in the arches, (from unequal or moving loads or from vibrations) and also to take up the thrust on the end beams of each floor, it is necessary to place lines of tie-rods across the entire line of beams. The size of these rods can be calculated as already explained in the Chapter on Arches (p. 215, No. 619); they are usually made, however, from $\frac{5}{8}''$ to $\frac{7}{8}''$ diameter. Each rod extends from the outside web of one beam to the outside web of the next beam. The next rod is a little to one side of it, so that the rods do not really form one straight line, but every other rod falls in the same line. Care must be taken not to get the rods too long, or there will have to be several washers under the head and nut, making a very unsightly job, to say the least. Contractors will do this however, for the sake of the convenience of ordering the rods all of one or two lengths. Where, therefore, the beams are not spaced evenly the contractor should be warned against this. One end of the rod has a "head" welded on, the other has a "screw-end," which need not be "up-set;" the nut is screwed along this end, thus forcing both nut and head to bear against the beams solidly. The distance between lines of tie-rods, would depend somewhat on our calculation, if made; the usual practice, however, is to place them apart a distance equal to about twenty times the width of flange of a single beam.

Flitch-plate Girder.

Sometimes where wooden girders have heavier loads to carry than they are capable of doing and yet iron girders cannot be afforded, a sheet of plate-iron is bolted between two wooden girders. In this case care must be taken to so proportion the iron, that in taking its share of the load, it will *deflect* equally with the wooden girders, otherwise the bolts would surely shear off, or else crush and tear the wood.

We consider the two wooden girders as one girder and calculate (or read from Table XIII) their safe load, taking care not to exceed 0,03 inches of deflection per foot of span. We then, from Table VII or Formulæ (37) to (41) obtain the exact amount of their deflection under this load. We now calculate the iron plate, for deflection only, inserting the above amount of deflection, and for the load the balance to be borne by the iron-work. An example will best illustrate this:

Example.

A Flitch-plate girder of 20-foot span consists of two Georgia pine beams each $6'' \times 16''$ *with a sheet of plate-iron* $16''$ *deep bolted between them. The girder carries a load of* 13000 *pounds at its centre; of what thickness should the plate be? The girder supports a plastered ceiling.*

Strength of wooden part.

From Table XIII we find that a Georgia pine beam $6'' \times 16''$ of 20-foot span will safely carry without cracking plaster 7980 pounds uniform load, or 3990 pounds at its centre (See Case (6) Table VII,) so that the two wooden beams together carry 7980 pounds of the load, leaving a balance of 5020 pounds for the iron plate to carry. The deflection of a 20-foot span Georgia pine beam $6'' \times 16''$ with 3990 pounds centre load will be, Formula (40)

$$\delta = \frac{1}{48} \cdot \frac{3990. \; 240^3}{e. \quad i.}$$

e for Georgia pine (Table IV) is $= 1200000$ and

$$i = \frac{b.d^3}{12} \text{ (Table I. section No. 2), or}$$

$$i = \frac{6.16^3}{12} = 2048, \text{ therefore}$$

$$\delta = \frac{1}{48} \cdot \frac{3990. \quad 240^3}{1200000. \; 2048} = 0{,}47''$$

Size of Iron Plate.

We now have a wrought-iron plate which must carry 5020 pounds centre load, of a span of 20 feet, $16''$ deep, and must deflect under this load only $0{,}47''$.

Inserting these values in Formula (40) we have:

$$0{,}47 = \frac{1}{48} \cdot \frac{5020.240^3}{e. \quad i.}$$

From Table IV we have for wrought-iron

$$e = 27000000$$

While for i, we have (Table I. Section No. 2)

$$i = \frac{b.d^3}{12} = \frac{b.16^3}{12} = 341.b$$

Inserting these values and transposing we have:

$$b = \frac{5020. \quad 240^3}{48. \; 27000000. \; 341. \; 0{,}47} = 0{,}33$$

Or the plate would have to be $\frac{1}{3}'' \times 16''$. Now to make sure that this deflection does not cause too great fibre strains in the iron, we can calculate these from Formulæ (18) and (22). The bending moment at the centre will be (22)

$$m = \frac{5020. \; 240}{4} = 301200$$

The moment of resistance will be (Table I. Section No. 2)

$$r = \frac{b.d^2}{6} = \frac{0{,}33.16^2}{6} = 14$$

And from (18) $\frac{m}{\left(\frac{k}{f}\right)} = r$, or transposing and inserting values,

$$\left(\frac{k}{f}\right) = \frac{301200}{14} = 21514 \text{ pounds.}$$

As the safe modulus of rupture of wrought-iron is only 12000 pounds (Table IV) we must increase the thickness of our plate. Let us call the plate $\frac{5}{8}'' \times 16''$, we should then have

$$r = \frac{5.\ 16^2}{8.\ 6} = 26{,}67 \text{ and}$$

$$\left(\frac{k}{f}\right) = \frac{301200}{26{,}67} = 11256.$$

So that the plate would be a trifle too strong. This would mean that both plate and beams would deflect less. The exact amount might be obtained by experimenting, allowing the beams to carry a little less and the plate a little more, until their deflections were the same, but such a calculation would have no practical value. We know that the deflection will be less than 0, 47″ and further that plastering would not crack, unless the deflection exceeded $\frac{3}{8}''$ of an inch (Formula 28) as

$$20.0{,}03 = 0,\ 6''$$

Size of Bolts. In regard to the bolts the best position for them would, of course, be along the neutral axis, that is at half the height

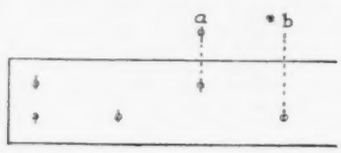


Fig. 137.

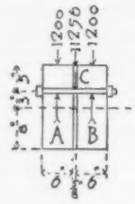


Fig. 138.

of the beam. For here there would be no strain on them. But to place them with sufficient frequency along this line would tend to weaken it too much, encouraging the destruction of the beam from longitudinal shearing along this line. For this reason the bolts are placed, alternating, above and below the line, forming two lines of bolts, as shown in Fig. (137). The end bolts are doubled as shown; the horizontal distance, $a-b$, between two bolts should be about equal to the depth of the beam. If we place the bolts in our example, say 3″ above and 3″ below the neutral axis, we can readily calculate the size required. Take a cross-section of the beam (Fig. 138) showing one of the upper bolts. Now the fibre strains along the upper edge of the girder, we know are $\left(\frac{k}{f}\right)$ or 1200 pounds per square inch, for the wood, and we just found the balance of the load coming on the iron would strain this on the extreme upper edge $= 11256$ pounds per square inch. As the centre line of the bolt is only 3″ from the neutral axis or $\frac{3}{8}$ of the distance from neutral axis to the extreme upper fibres, the strains on the fibres along this line will be, of course, on the wood $\frac{3}{8}$ of 1200, or 450 pounds per square inch: and on the iron $\frac{3}{8}$ of $11256 = 4221$ pounds per square inch. Now, supposing the bolt to be 1″ in diameter. It then presses on each side against a surface of wood $= 1'' \times 6''$ or $=$ six square inches. The fibre strain being 450 pounds per square inch, the total pressure on the bolt from the wood, each side, is:

$$6.450 = 2700 \text{ pounds.}$$

On the iron we have a surface of $1'' \times \frac{5}{8}'' = \frac{5}{8}$ square inches. And as the fibre strain at the bolt is 4221, the total strain on the bolt from the iron is $= \frac{5}{8}$. $4221 = 2638$ pounds. Or, our bolt virtually becomes a beam of wrought-iron, circular and of 1″ diameter in cross-section, supported at the points A and B, which are $6\frac{5}{8}''$ apart, and loaded on its centre C with a weight of 2638 pounds.

Therefore we have, at centre, bending-moment (Formula 22)

$$m = \frac{2638.\ 6\frac{5}{8}}{4} = 4369.$$

From Table I, Section No. 7, we know that for a circular section, the moment of resistance is,

$$r = \frac{11}{14} \cdot \mathfrak{r}^3 = \frac{11}{14} \cdot \left(\frac{1}{2}\right)^3 = 0{,}098$$

Now for solid circular bolts, and which are acted on really along their whole length it is customary to take $\left(\frac{k}{f}\right)$ the safe modulus of rupture rather higher than for beams. Where the bolts or pins have heads and nuts at their ends firmly holding together the parts acting across them they are taken at 20000 pounds for steel and at 15000 pounds for iron. We have therefore from (Formula 18) for the required moment of resistance

$$r = \frac{4369}{15000} = 0{,}291.$$ Inserting this value for r in the above we have for the radius of bolt,

$$\frac{11}{14} \cdot \mathfrak{r}^3 = 0{,}291 \text{ and}$$

$$\mathfrak{r} = \sqrt[3]{\frac{14}{11} \cdot 0{,}291} = \sqrt[3]{0{,}3704}$$
$$= 0{,}718''$$

Or the diameter of bolt should be 1,436″ or say 1 7-16″. But 1″ will be quite ample, as we must remember that the strains calculated will come only on the one bolt at the centre of span of beam; and that, as the beam remains of same cross section its whole length the extreme fibre strains decrease rapidly towards the supports, and therefore also the strains on the bolts. The end bolts are doubled however, to resist the starting there of a tendency to longitudinal shearing. We might further calculate the danger of the bolt crushing the iron plate at its bearing against it; or crushing the wood each side; or the danger of the iron bolt being sheared off by the iron plate between the wooden beams; or the danger of the iron bolt shearing off the wood in front of it, that is tearing its way out through the wood; but the strains are so small, that we can readily see that none of these dangers exist.

Keyed Girders. Another method of adding to the sum of the separate strengths of the girders is to place one under the other making a straight joint between the two parts and to drive in hard wood keys, as shown in Fig. 140.

The keys can either be made a trifle thicker than the holes and the beams then firmly bolted together so as to take hold of keys securely; or, keys can be shaped in two wedged-shaped pieces to each key, and driven into the hole from opposite sides, after the beams are firmly bolted. In the latter case, care must be taken that the joint between the opposite wedges is slanting or diagonal, and *not horizontal* or else, of course,

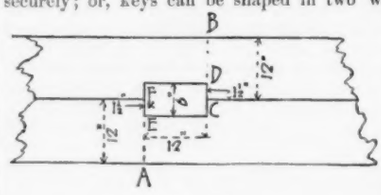


Fig. 139.

the keys would be useless. Either method allows, for tightening up, after shrinkage has taken place. Iron bands are frequently used in place of bolts but they are more clumsy, less liable to *all* fit exactly, and besides do not allow for tightening up so easily as with bolts. Where beams are very wide, however, the bands are very advantageous. Tredgold says the keys should be twice as wide, as high; and that the sum of all their heights should equal one and a third times the depth of girder. They can be easily calculated, however. As the main strain on them is a horizontal shearing strain, and the stress or resistance to shearing is greatest *across* the grain the keys should of course, be placed with their grain running as nearly as possible vertically. Of course, as the greatest horizontal shearing exists near the supports, the end wedges should be the strongest; it is customary, however, to make them all of the same size for convenience of execution. The amount of the horizontal shearing is found by Formula (13).

Horizontal shearing on Keys.

Besides the horizontal shearing strain there will also be a crushing strain on the sides of wedges, which will be greatest, where the greatest fibre strains exist. This of course, is at the point of the greatest bending moment on the beam. Let us consider the wedge at A – B Fig. (140) which has been drawn enlarged in Fig. (139.)

Compression on Keys.

The lower half of the girder, being in tension, in trying to stretch its fibres meets with the resistance of the wedge along E F, therefore

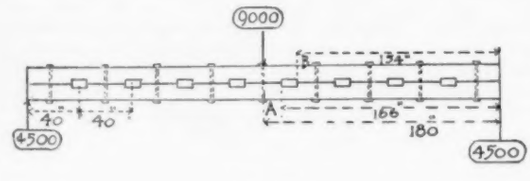


Fig. 140.

tends to crush or compress this surface. The amount of this compression, per square inch, will be equal to the average fibre strain between E and F. Now the fibre strain at A can be readily found, by finding the "bending moment" at A and dividing this by the moment of resistance of the girder (see Table I) and Formula (18). This gives the fibre strains at A. The average fibre strain on E F will be to the strain at A as the distance of x from the neutral axis, is to the depth of half the beam; x being the centre of E F, or:

Extreme fibre strain a: average fibre strain on wedge $=$ E A : E x. The amount of the compression on E F will of course equal the area of wedge at E F (that is E F multiplied by the breadth of girder), and this area multiplied by the average fibre strain on E F. The greatest compression on E F will of course be at F, and equal to twice the average fibre strain, as E F $= 2.$ E x.

In the same way, we find that the upper half of the girder, being in compression, is forcing its fibres towards the centre causing compression on the surface D C. The amount of this compression is found similarly as for that on E F, the only difference being in the difference in bending moments at B and A. The key therefore becomes virtually a cantilever, the built-in part being between E F and C, and the load applied on the free end C D, the load being a uniform one and equal to the amount of the compression on C D.

Weakest Point of Girder. The weakest point of the girder itself will be either at the point of greatest bending moment, or at key nearest to it, where, of course the girder will not be of full section, being weakened in the part cut away for key. An example will more fully illustrate all of the foregoing.

Example.

A spruce girder (Fig. 140) of 30-foot clear span is built up of two girders 10″ × 12″ each, making the whole section 10″ × 24″. Georgia pine keys are used, each 6″ × 12″ (and, of course) 10″ across girder; they are placed with grain vertically 3′ 4″ between centres and same distance from centre of last key to support. The girder helps support a plastered ceiling. What is the safe centre load on girder?

Calculation of Keyed girder. The girder is (d =) 24″ deep and (L =) thirty feet long; now $1\frac{1}{8}$ L. would be 35, therefore d is less than $1\frac{1}{8}$ L, and from rule contained in Table VIII for spruce we must calculate for deflection, not rupture, in order to be safe. Formula (40) gives the rule for deflection of a centre load on a girder or beam. It is:

$$\delta = \frac{1}{48} \cdot \frac{w.l^3}{e.i.} \text{ or transposing,}$$

$$w = \frac{\delta.48.e.i}{l^3} \text{ where } w \text{ would be the safe centre load, in}$$

pounds. Now in order not to crack plastering, we have from Formula (28)

$$\delta = L.\ 0{,}03 \text{ or}$$
$$\delta = 30.\ 0{,}03$$
$$= 0{,}9.$$

From Table IV we have for spruce:

$$e = 850000$$

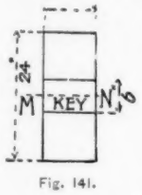


Fig. 141.

From Table I, Section No. 17, we have for the weakest section of the girder, which would be through a key, and as shown in Fig. 141,

$$i = \frac{b}{12} \cdot (d^3 - d_1^3)$$
$$= \frac{10}{12} \cdot (24^3 - 6^3) = 11340, \text{ therefore}$$

inserting these values in the transposed Formula (40)

$$w = \frac{0{,}9.\ 48.\ 850000.\ 11340}{360^3}$$
$$= 8925$$

Or the safe centre load, not to crack plastering, would be, say 9000 pounds.

End Keys. Now let us try the keys. We first take the greatest horizontal shearing, which will be at the end keys.

The vertical shearing at these keys will be equal to the reaction (see Table VII, or Formula 11.)

As the load is central, each reaction will, of course, be one-half the load, or 4500 pounds, therefore the vertical shearing strain at end key, will be (a little less than)

$$x = 4500$$

Now from Formula (13) we know that the horizontal shearing strain at the same point is:

$$\frac{3}{2} \cdot \frac{x}{a}$$

For the area we take the full area of cross-section or $a = 10.24 = 240$, therefore horizontal shearing strain:

$$\frac{3.\ 4500}{2.\ 240} = 28{,}125 \text{ pounds per square inch.}$$

The amount of this strain that will act on each key is, of course, equal to the area at the neutral axis from centre to centre of key, or 40. 10 = 400 square inches multiplied by the strain per square inch, or

$$400.\ 28{,}125 = 11250 \text{ pounds.}$$

To resist this we have a key 12″ × 10″ = 120 square inches, being sheared across the grain. From Table IV we know that the safe shearing stress of Georgia pine across the grain or fibres, is:

$$\left(\frac{g}{f}\right) = 570 \text{ pounds so that the key could safely stand an}$$

amount of horizontal shearing

$$= 570.\ 120 = 68400 \text{ pounds}$$

or more than six times the actual strain. Had we, however, placed the grain of the key horizontal, the shearing would be with the grain or along the fibres; the safe shearing stress this way for Georgia pine (Table IV) is only 50 pounds per square inch, so that the key would only have resisted

$$= 50.120 = 6000 \text{ pounds, or it would have been in}$$

serious danger of splitting in two.

Central Keys. Now take the Key A B immediately to the right of the weight. The bending-moment at A will be (Table VII)

$$m_A = 4500.166 = 747000$$

and at B

$$m_B = 4500.154 = 693000$$

Now at A and B, the girder being uncut, the moment of resistance will be (Table I, Section No. 2)

$$r = \frac{10.\ 24^2}{6} = 960$$

Dividing the bending moment by the moment of resistance (Formula 18 transposed) gives the extreme fibre strains,

$$\text{at A} = \frac{747000}{960} = 778 \text{ pounds.}$$

$$\text{and at B} = \frac{693000}{960} = 722 \text{ pounds.}$$

Now the centres (X and Y, see Fig. 139) of each side of key will be $1\frac{1}{2}$″ from neutral axis, the extreme fibres being, of course, 12″ distant from neutral axis, therefore average strain on side of key at A. (Or

$$X, \text{ Fig. 139}) = \frac{1\frac{1}{2}}{12} \cdot 778 = 97 \text{ pounds,}$$

$$\text{and at B (or } Y, \text{ Fig. 139}) = \frac{1\frac{1}{2}}{12} \cdot 722 = 90 \text{ pounds.}$$

The extreme compression, will, of course, be on the lower edge of key, at A and will be = 2.97 = 194 pounds per square inch. From Table IV we find that Georgia pine will safely stand a pressure of 200 pounds per square inch, *across* the fibres, so that we are just a little inside of the safety mark. We now have to consider our key as a cantilever with cross-section 10″ wide and 12″ deep, projecting 3″ beyond the support and loaded uniformly with a weight equal to 90 pounds per square inch, or

$$u = 90.3.10 = 2700 \text{ pounds.}$$

Now the bending moment at support is, (Formula 25.)

$$m = \frac{2700.3}{2} = 4050 \text{ pounds.}$$

The moment of resistance (Table I, Section 2) is

$$r = \frac{10.12^2}{6} = 240$$

Therefore (Formula 18) the extreme fibre strains on key

$$= \frac{m}{r} = \frac{4050}{240} = 17 \text{ pounds.}$$

Or not enough to be even considered seriously.

Notched girders. Another method of combining and strengthening wooden girders, is to cut them with saw-shaped notches, as shown in (Fig. 142) and fit the teeth closely together, firmly bolting the two parts together, so as to force them to act

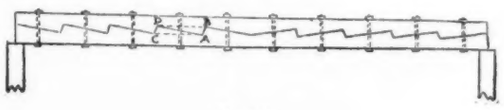


Fig. 142.

together as one girder. Sometimes the top surface slants towards each end, and iron bands are driven on towards the centre, till they are tight. But bolts are more reliable, and not likely to slip; where the girder is broad, they should be doubled, that is, placed in pairs across the width of girder. The distance between bolts should not exceed twice the depth of girder. Great care must be taken to get the right side up. Many text-books even being careless in this matter. It must be remembered that the upper fibres are in compression, crowding towards the centre, while the lower ones, in tension, are pressing away.

The girder must therefore be placed, as shown, so that the two sets of fibres will meet at the short joints and oppose each other. The girder is easily calculated similarly to the former example. The crushing on C D or A B can be found, and also the stress on their extreme edges; this must not exceed the safe stress of the material for compression across the fibres. Then D B or C A must have area sufficient to resist the horizontal strain.

Size of Bearings. In all these girders the most careful fitting of joints is necessary; then, too, the ends must have sufficient bearing not to crush under the load. Thus, take the former example, the reaction was 4500 pounds; the safe resistance of spruce to crushing across the fibres is (Table IV) = 75 pounds.

We need therefore an area $= \frac{4500}{75} = 60$ square inches, and as the girder is 10″ broad it should bear on each support $\frac{60}{10} = 6$ inches. The end of girder should be deep enough to resist vertical shearing. In our case it is trifling, and we need not consider it. In all of these examples we have omitted the weight of the girder, to avoid complication. This should really be taken into account, in such a long girder, and treated as an additional but uniform load.

Continuous Girders. When girders run over three or more supports in one piece, that is, are not cut apart or jointed over the supports, the existing strains and reactions of ordinary girders, are very much altered. These are known as "continuous girders." If we have (Fig. 143) three supports, and run a continuous girder over them in one piece and load the girder on each side it will act as shown in Fig. 143; if the girder is cut it will act as shown in Fig. 144. Very little thought will show that the fibres at A not being able to separate in the first case, though they want to, must cause considerable tension in the upper fibres at A. This tension, of course, takes up or counterbalances part of the compression existing

there, and the result is that the first or continuous girder (Fig. 143) is considerably stronger, that is, it is less strained and considerably stiffer than the sectional or jointed girder (Fig. 144). Again we

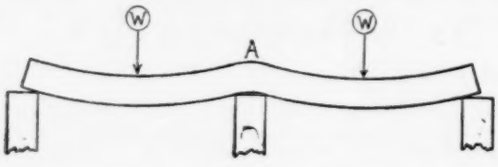


Fig. 143.

can readily see that the great tension and conflict of the opposite stresses at A would tend to cause more pressure on the central post in Fig. 143, than on the central post in Fig. 144, and this, in fact, is the case. Below are given the various formulæ for reactions, greatest bending moments and deflections, for the most usual cases of continuous girders. The architect can, if he wishes, neglect to allow for the additional strength and stiffness of continuous girders, as both are on the safe side. But he must never overlook the fact

Variation of Reactions.

that the central reactions are much greater, or in other words, that the end supports carry *less*, and the central supports carry *more*, than when the girders are cut.

Bending moments can be figured, at any desired point along a

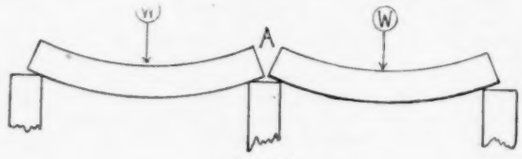


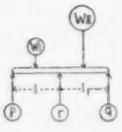
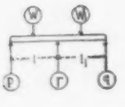
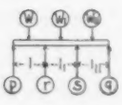
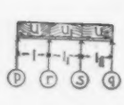
Fig. 144.

continuous girder, as usual, subtracting from the sum of the reactions on one side multiplied by their respective distances from the point, the sum of all the weights on the same side, multiplied by their respective distances from the point. Sometimes the result will be negative, which means a reversal of the usual stresses and strains. Otherwise the rules and formulæ hold good, the same as for other girders or beams. The following Table gives all necessary information at a glance.

Louis De Coppet Berg.

TABLE XVII.

CONTINUOUS GIRDERS.

Illustration.	Description.	Amount of Reactions.	Amount of Greatest Bending Moments.	Amount of Greatest Deflections.
	Two equal spans each carrying a central load but loads not equal. $w_i \leq w_{ii}$ $l = l_i$	*Left reaction.* $p = \frac{13 \cdot w_i - 3 \cdot w_{ii}}{32}$ *Centre reaction.* $r = \frac{11}{16} \cdot (w_i + w_{ii})$ *Right reaction.* $q = \frac{13 \cdot w_{ii} - 3 \cdot w_i}{32}$	*Located at r* $m = \frac{3}{32} \cdot l \cdot (w_i + w_{ii})$	*Deflection in left span l* $\delta_i = \frac{23 \cdot w_i - 9 \cdot w_{ii}}{1536 \cdot e \cdot i} \cdot l^3$ *Deflection in right span l_i* $\delta_{ii} = \frac{23 \cdot w_{ii} - 9 \cdot w_i}{1536 \cdot e \cdot i} \cdot l^3$
	Two equal spans each carrying a central load $= w$, loads equal. $w = w_i$ $l = l_i$	*End reactions.* $p = q = \frac{5}{16} \cdot w$ or $= \frac{5}{32} \cdot (w + w_i)$ *Centre reaction.* $r = \frac{11}{8} \cdot w$ or $= \frac{11}{16} \cdot (w + w_i)$	*Located at r* $m = \frac{3}{16} \cdot l \cdot w$ or $= \frac{3}{32} \cdot l \cdot (w + w_i)$	*Deflection in either span* $\delta = \frac{w \cdot l^3}{110 \cdot e \cdot i}$ or $= \frac{l^3}{220 \cdot e \cdot i} \cdot (w + w_i)$
	Two equal spans each loaded with a uniform load $= u$ $u = u_i$ $l = l_i$	*End reactions.* $p = q = \frac{3}{8} \cdot u$ or $= \frac{3}{16} \cdot (u + u_i)$ *Centre reaction.* $r = \frac{5}{4} \cdot u$ or $= \frac{5}{8} \cdot (u + u_i)$	*Located at r* $m = \frac{u \cdot l}{8}$ or $= \frac{l}{16} \cdot (u + u_i)$	*Deflection in either span* $\delta = \frac{u \cdot l^3}{185 \cdot e \cdot i}$ or $= \frac{l^3}{370 \cdot e \cdot i} \cdot (u + u_i)$
	Three equal spans each carrying a central load $= w$, all loads equal $w = w_i = w_{ii}$ $l = l_i = l_{ii}$	*End reactions.* $p = q = \frac{7}{20} \cdot w$ or $= \frac{7}{60} \cdot (w + w_i + w_{ii})$ *Central reactions.* $r = s = \frac{23}{20} \cdot w$ or $= \frac{23}{60} \cdot (w + w_i + w_{ii})$	*Located at r or s* $m = \frac{3 \cdot w \cdot l}{20}$ or $= \frac{l}{20} \cdot (w + w_i + w_{ii})$	*Deflection in central span* $\delta = \frac{w \cdot l^3}{480 \cdot e \cdot i}$ or $= \frac{l^3}{1440 \cdot e \cdot i} \cdot (w + w_i + w_{ii})$ *Deflection in either end span* $\delta = \frac{w \cdot l^3}{87 \cdot e \cdot i}$ or $= \frac{l^3}{261 \cdot e \cdot i} \cdot (w + w_i + w_{ii})$
	Three equal spans each loaded with a uniform load $= u$ $u = u_i = u_{ii}$ $l = l_i = l_{ii}$	*End reactions.* $p = q = \frac{2}{5} \cdot u$ or $= \frac{2}{15} \cdot (u + u_i + u_{ii})$ *Central reactions.* $r = s = \frac{11}{10} \cdot u$ or $= \frac{11}{30} \cdot (u + u_i + u_{ii})$	*Located at r or s* $m = \frac{u \cdot l}{10}$ or $= \frac{l}{30} \cdot (u + u_i + u_{ii})$	*Deflection in central span* $\delta = \frac{u \cdot l^3}{1920 \cdot e \cdot i}$ or $= \frac{l^3}{5760 \cdot e \cdot i} \cdot (u + u_i + u_{ii})$ *Deflection in either end span* $\delta = \frac{u \cdot l^3}{145 \cdot e \cdot i}$ or $= \frac{l^3}{435 \cdot e \cdot i} \cdot (u + u_i + u_{ii})$

Where w, w_i, w_{ii} = central concentrated loads in pounds, on either span, being equal, when so stated.
" l, l_i, l_{ii} = the length of respective spans, in inches, all being equal.
" u, u_i, u_{ii} = uniform loads on each span, in pounds, all being equal.
" p, r, s, q, = the amount of respective reactions, in pounds.
" m = the bending moment, in pounds-inch.

Where $\delta, \delta_i, \delta_{ii}$ = the amount of deflection in inches, if girder of uniform cross-section throughout.
" e = the modulus of elasticity of the material, in pounds-inch, (see Table IV).
" i = the moment of inertia of the cross-section, in inches, (see Table I).

[To be continued.]

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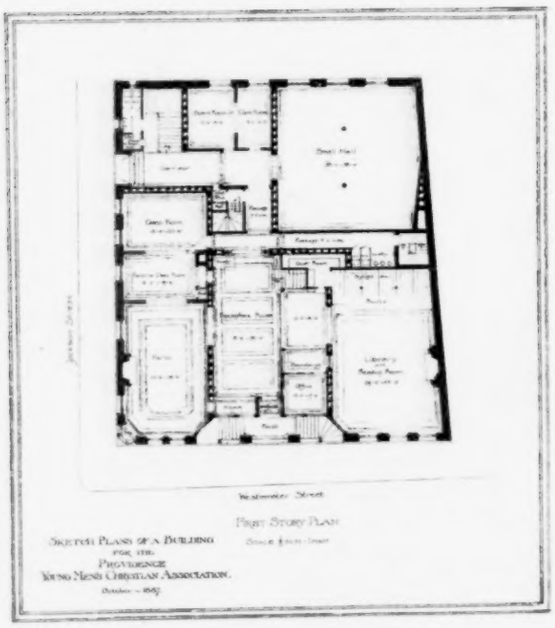
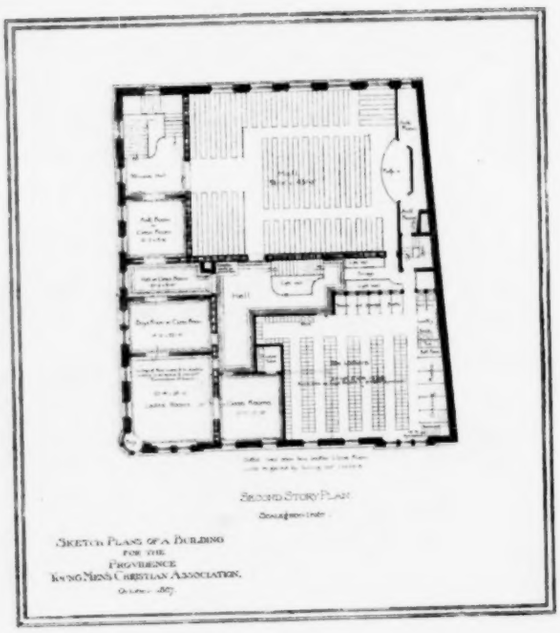


Westminster Street.

First Story Plan

Sketch Plans of a Building for the Providence Young Mens Christian Association.

October — 1887.



Second Story Plan

Sketch Plans of a Building for the Providence Young Mens Christian Association.

October — 1887.

Design of a Building for the Young Mens Christian Association

Cor. Westminster and Washington Streets

Providence, R. I.

October 1887.

Heliotype Printing Co. Boston.

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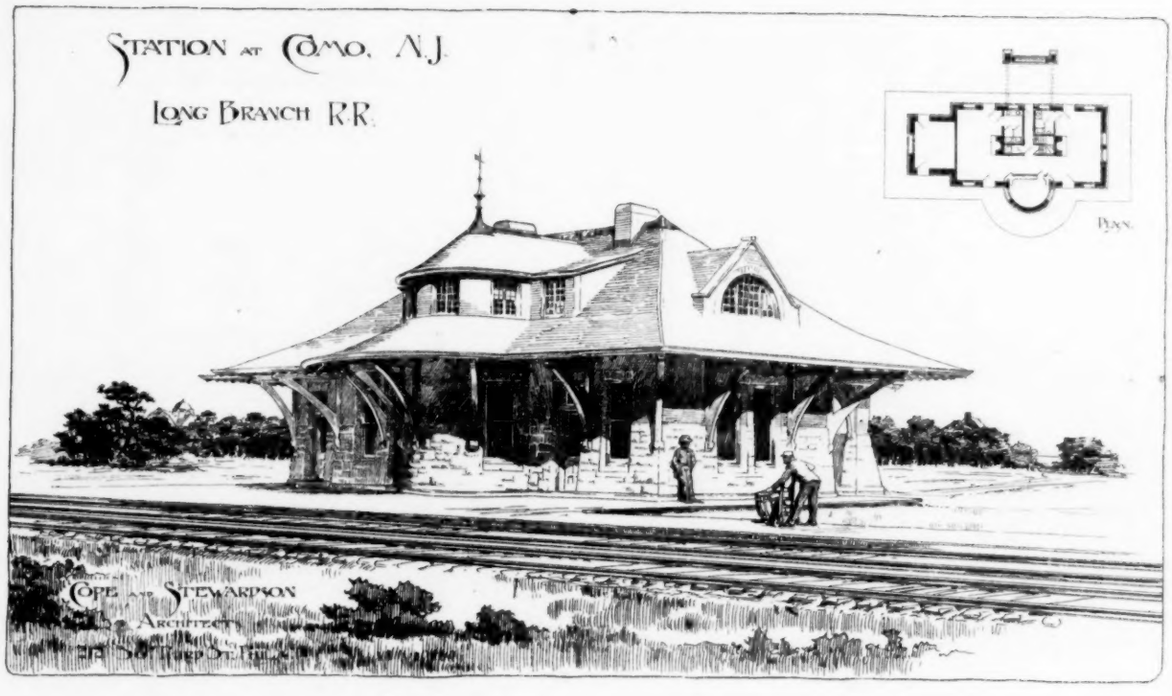

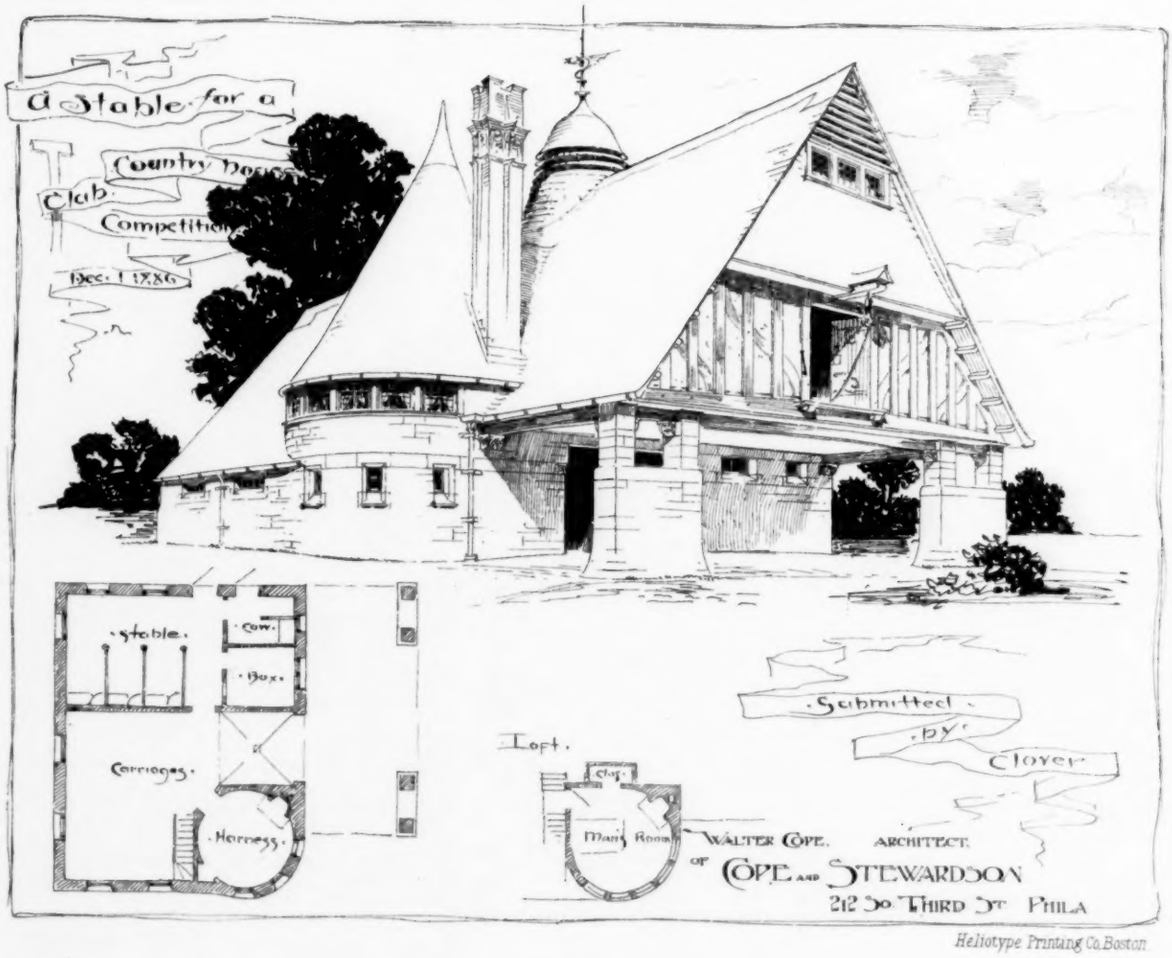

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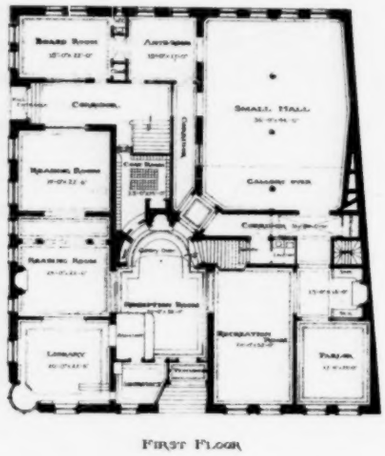
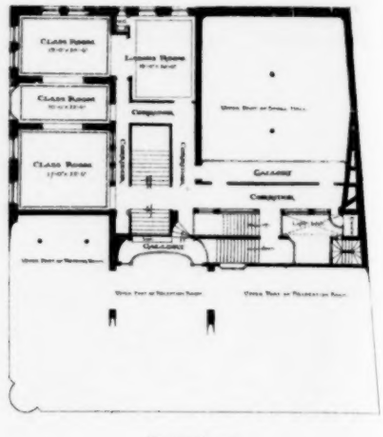
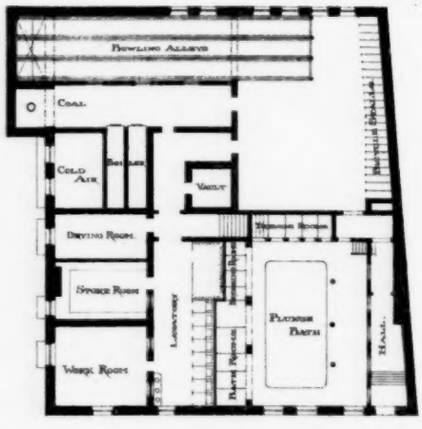


FIRST FLOOR



HALF STORY



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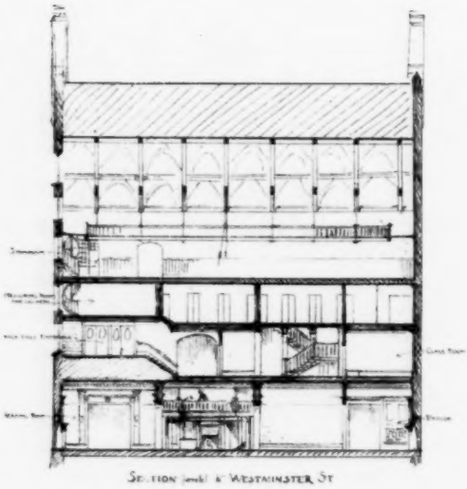

SECTION on E. WESTMINSTER ST

PLANS OF PROPOSED B
PROVIDENCE YOUNG MEN'S C
As Amended from Ac
STONE, CARPENTER AND WILLSON, A

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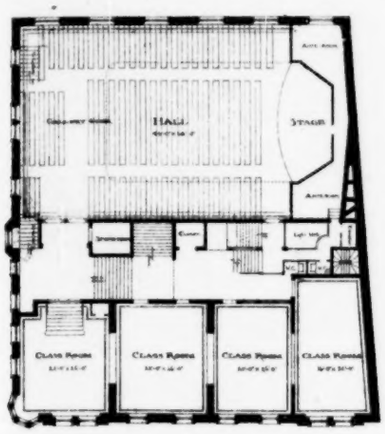

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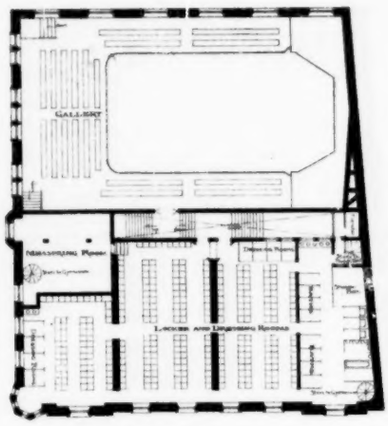

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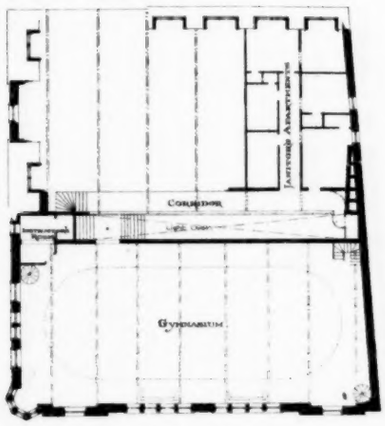
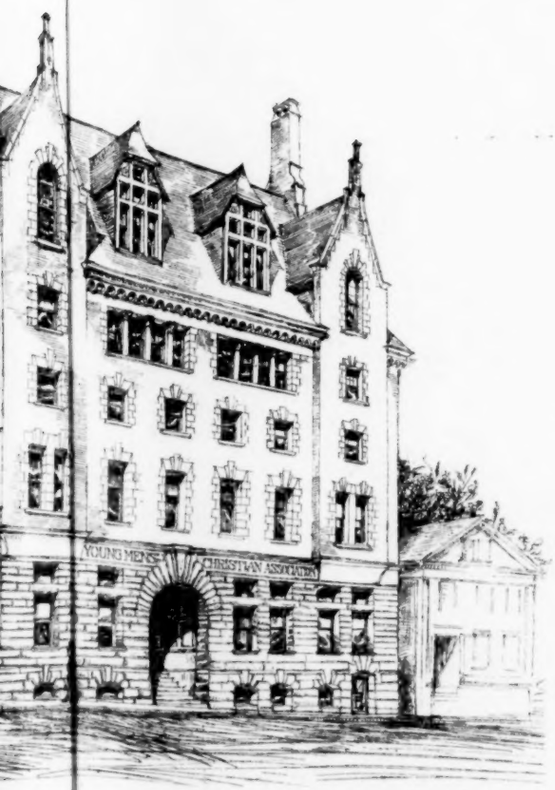
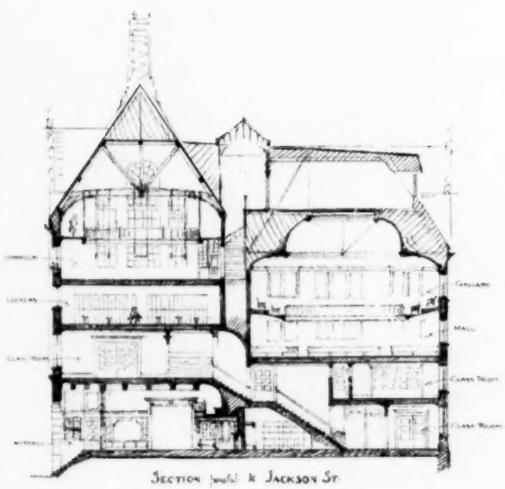


FOURTH FLOOR





SECTION [illegible] & JACKSON ST.

OSED BUILDING FOR THE
MEN'S CHRISTIAN ASSOCIATION
rom Accepted Design
LLSON, ARCHITECTS 65 WESTMINSTER ST., PROVIDENCE, R.I.

Heliotype Printing Co. Boston.

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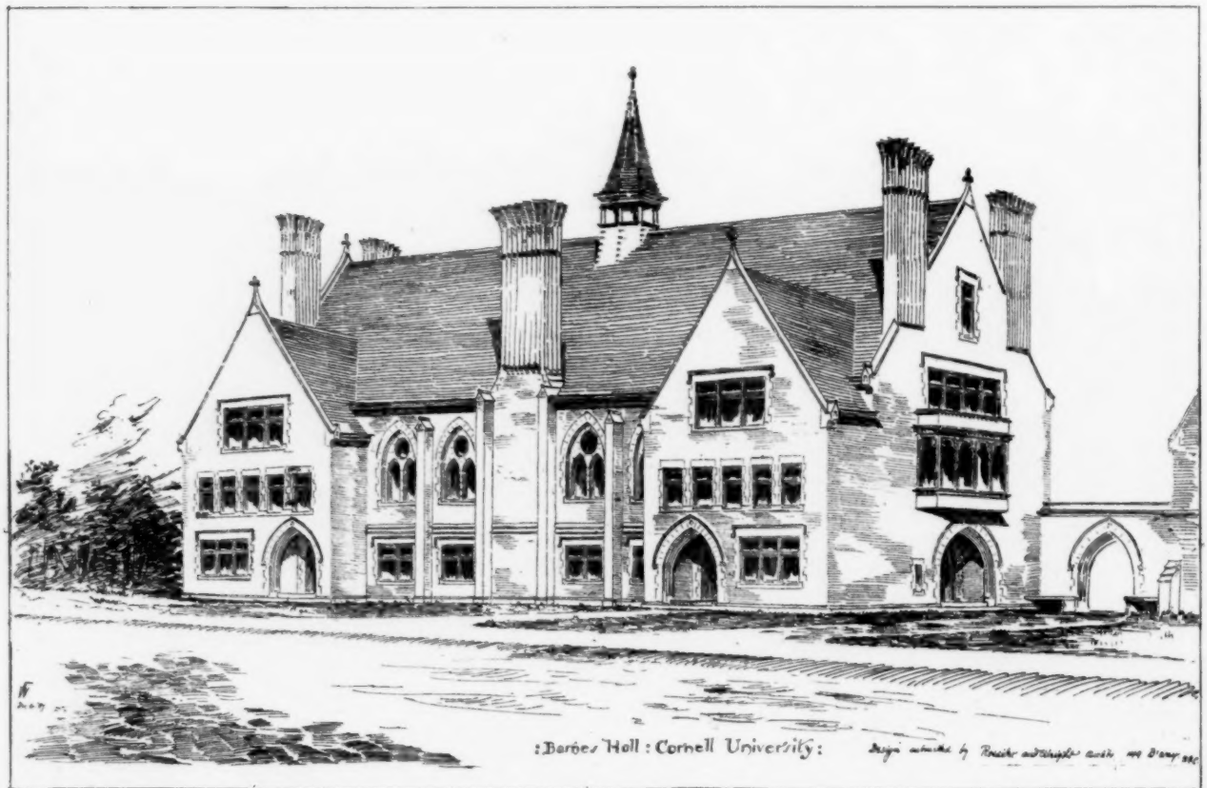
House near St Louis Missouri

Wm S. Eames: Th: C. Young: Architects
76 Turner Building
St Louis Mo.



: Barbee Hall : Cornell University :

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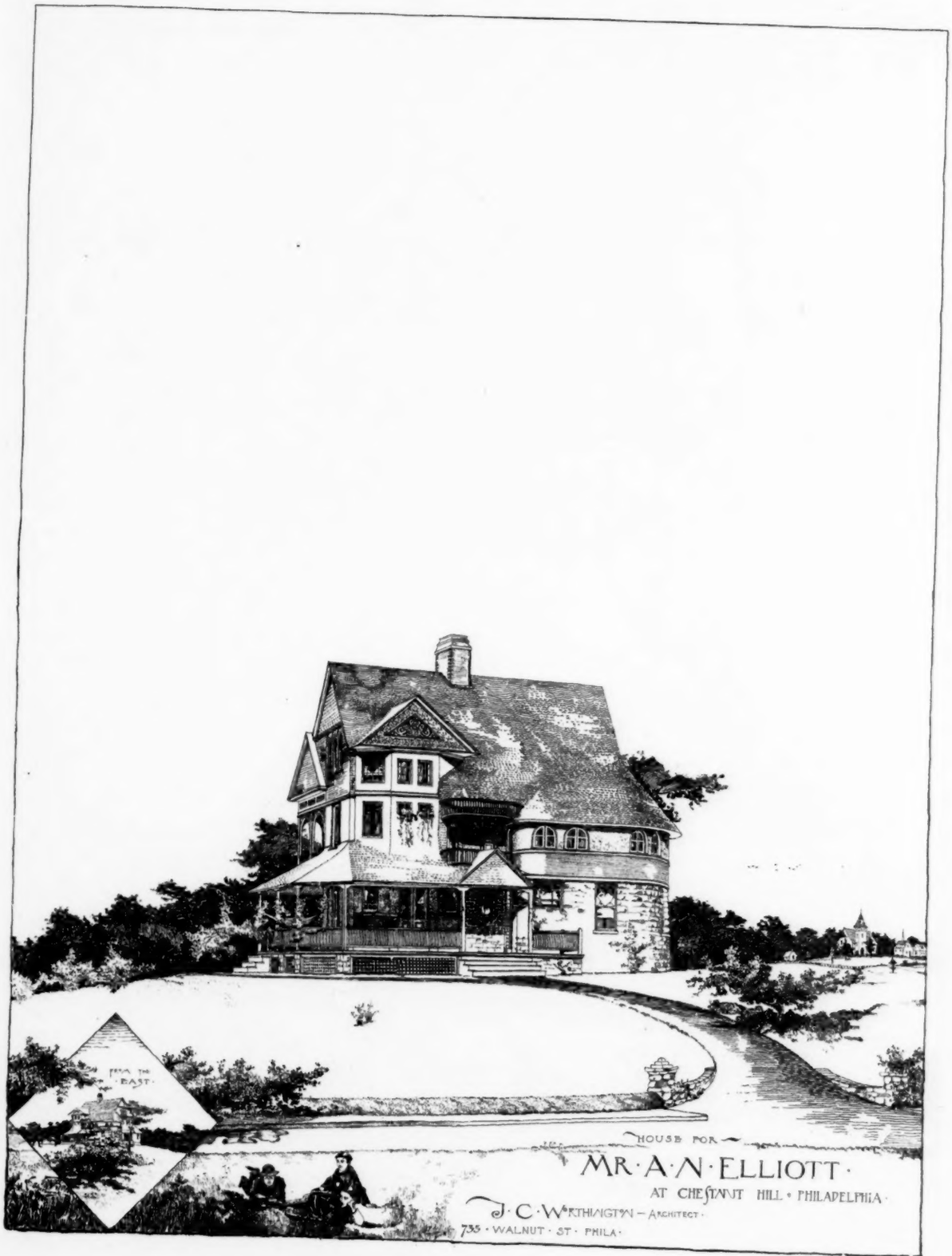

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